Ultrasound of Common Inflammatory Dermatologic Diseases

9

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Contents

9.1 Fluid Collections

9.1.1 Hematomas and Seromas

9.1.1.1 Definitions

In simple terms [1, 2]:

- *Hematoma:* Localized collection of blood in the tissues
- *Seroma:* Also called *lymphocele*, this is a localized collection of serous or lymphatic fluid in the tissues
- *Serohematoma:* Fluid collection that contains hematic and serous components

Electronic Supplementary Material The online version of this chapter (https://doi.org/10.1007/978-3-319-89614-4_9) contains supplementary material, which is available to authorized users.

X. Wortsman, *Atlas of Dermatologic Ultrasound*, https://doi.org/10.1007/978-3-319-89614-4_9

9.1.1.2 Key Sonographic Signs

- *Hematomas*
  - These appear as oval-shaped pockets of fluid with irregular borders. Their appearance can vary according to the phase of the hematoma. In the early phase, fresh blood may appear hyperechoic. Later, the fluid collection becomes anechoic, hypoechoic or presents a mixed hypoechoic-anechoic appearance, sometimes with some septa due to the presence of fibrinous components. During the regression period, hematomas tend to show mixed (anechoic-hypoechoic) or hypoechoic appearance (Fig. 9.1).
  - Commonly, hematomas affect the hypodermis; therefore, increased echogenicity in the periphery of the hematoma may be detected.
  - On color Doppler, increased vascularity can be detected in the periphery of the collection.
  - Hematomas tend to decrease in diameter over a short period of time, usually days.
  - Depending on their location, content, and phase, they tend to be compressible with the probe. Organized or hematomas in late-regression phase can have little or no compressibility because of the presence of fibrous components and scarring.
- *Seromas*
  - They show as anechoic oval-shaped or anfractuous pockets, band-like or thin laminar fluid collections, usually compressible with the probe.
  - These fluid collections decrease in diameter very slowly and may last for several months or even years.

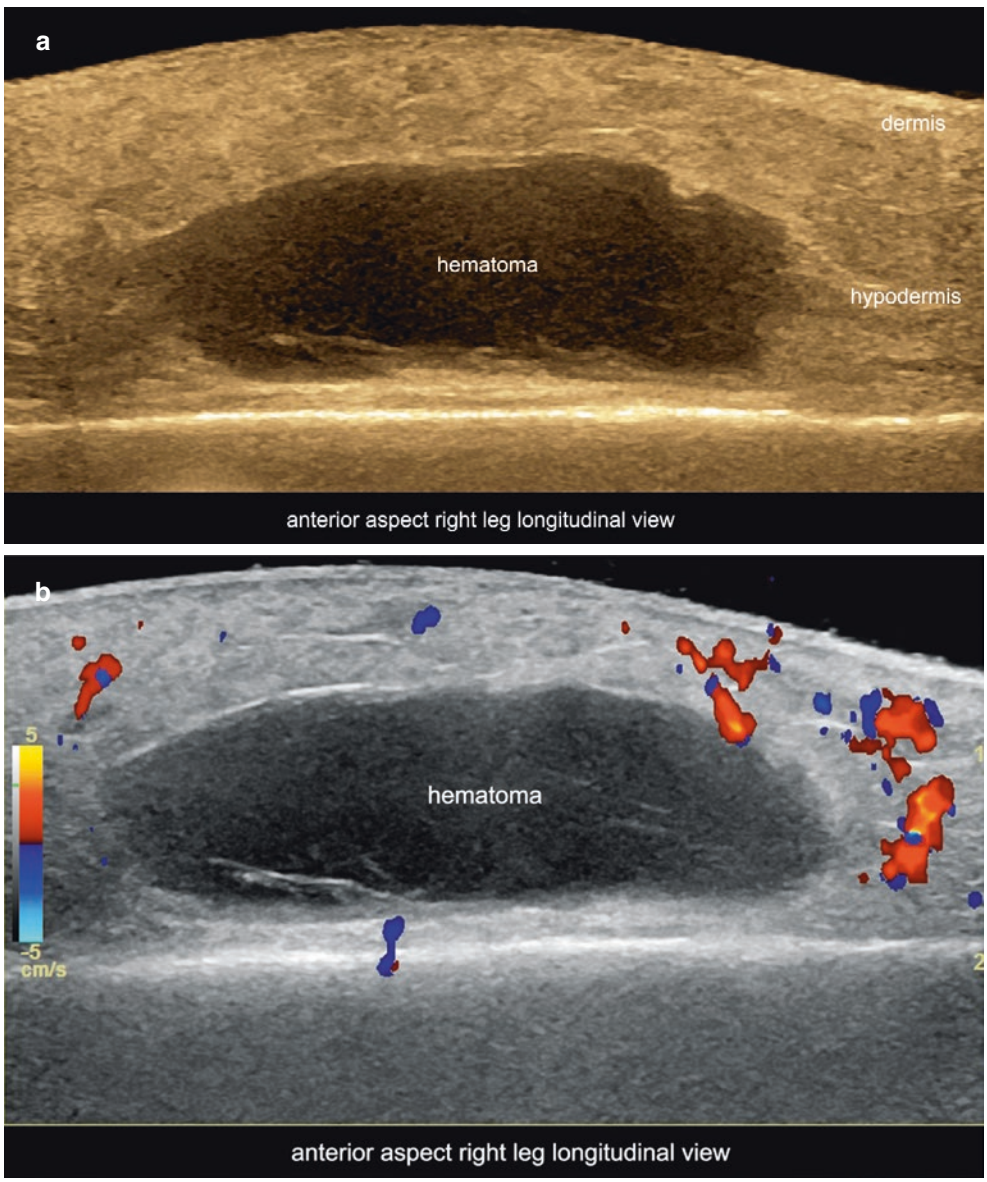


Fig. 9.1 Hematoma (anterior aspect right leg). Ultrasound longitudinal views (**a**, Greyscale with color filter; **b**, color Doppler demonstrate an oval-shaped anechoic fluid collection in the hypodermis with slightly irregular borders and some inner hyperechoic septa. Increased echogenicity of the surrounding hypodermis is detected. Notice the posterior acoustic reinforcement artifact due to the presence of fluid. Color Doppler shows increased vascularity in the periphery of the collection.

9.1.1.3 Tip

Hematomas and seromas usually do not show internal vascularity. If you detect vessels within a fluid collection, the presence of a tumor with hemorrhage and necrosis should be ruled out [1, 3].

9.1.2 Abscess

9.1.2.1 Definition

Localized fluid collection with purulent or infected material surrounded by inflammatory components in the tissues

9.1.2.2 Key Sonographic Signs

- Abscesses tend to appear as mixed echogenicity (anechoic and hypoechoic) fluid collections with irregular borders. Commonly, they show prominent inner echoes due to debris and hyperechoic fibrinous septa.
- There is increase echogenicity of the hypodermis and decreased echogenicity of the dermis in the periphery of the fluid collection (Fig. 9.2; Video 9.1).
- Color Doppler shows increased vascularity in the periphery of the abscess.
- These fluid collections may develop a draining, hypoechoic fistulous tract to the superficial tissues, which may displace upward or disrupt the epidermis. Occasionally, they can connect with deeper layers such as the fascia or the muscles.
- Ultrasound can support the monitoring of treatment and guide the percutaneous drainage of these collections [1, 4–7].

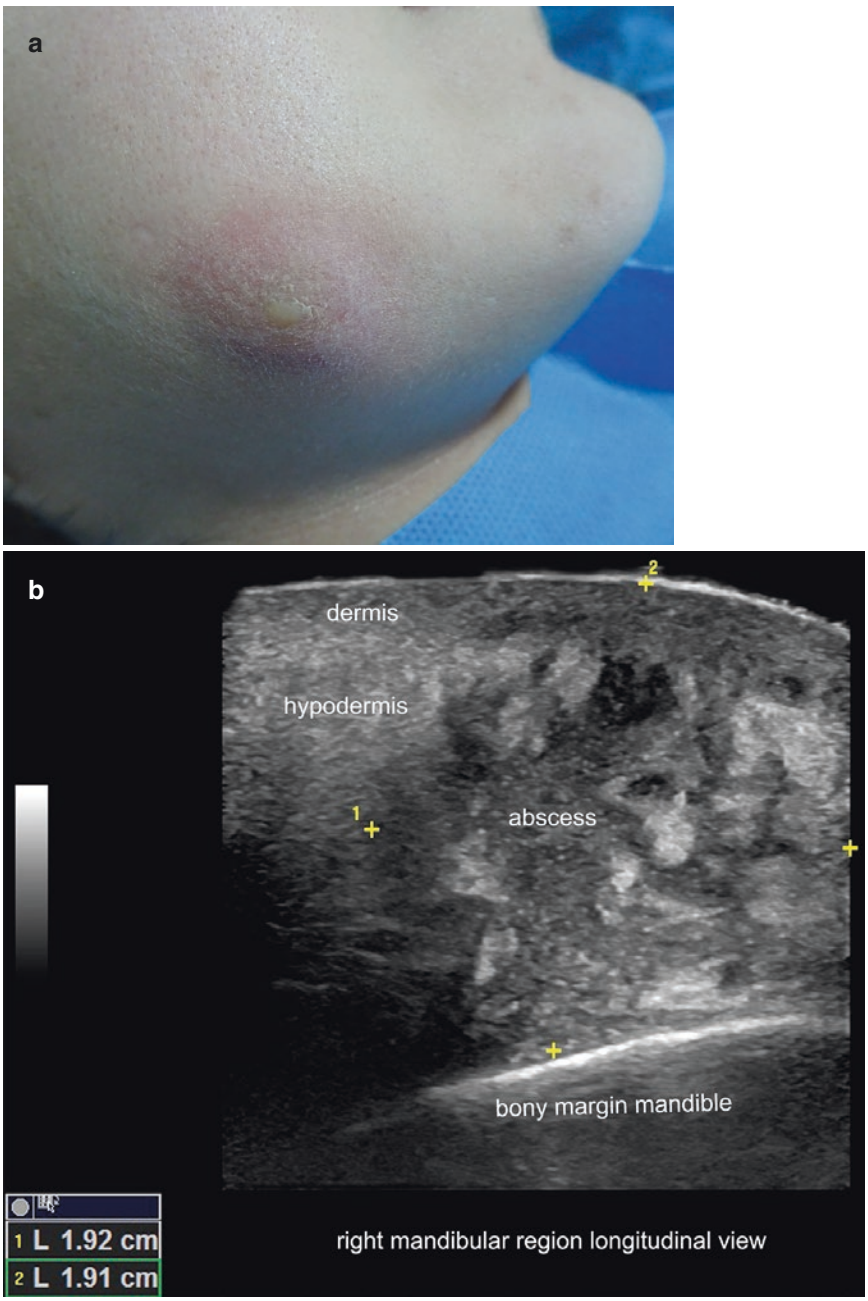


Fig. 9.2 Abscess. (**a**) Clinical image of the right mandibular region. (**b**, **c**) Ultrasound (**b**, greyscale and **c**, color Doppler; longitudinal views, right mandibular region) shows a hypoechoic hypodermal fluid collection with irregular borders and inner echoes. There is increased echogenicity of the surrounding hypodermis, as well as thickening and decreased echogenicity of the dermis. Notice the slight acoustic reinforcement artifact beneath the collection. On color Doppler, there is dermal and hypodermal increased vascularity in the periphery of the abscess. See Video 9.1.

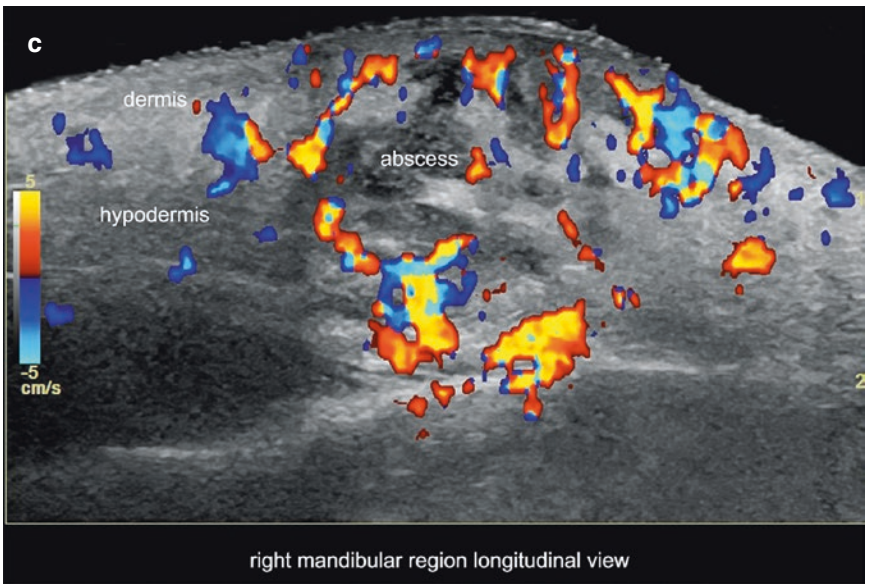


Fig. 9.2 (continued)

9.2 Edema/Lymphedema

9.2.1 Definition

- *Edema:* Swelling of the tissues due to an accumulation of fluid. In the soft tissues, edema can be caused by a failure of the venous and/or lymphatic systems to remove an excess of fluid.
- *Lymphedema:* Swelling of the tissues due to failure of drainage of the lymphatic fluid

9.2.2 Key Sonographic Signs

- *Edema*
  - Decreased echogenicity of the dermis and increased echogenicity of the hypodermis
  - Anechoic bands of compressible fluid between the fatty lobules of the hypodermis may be detected in more severe stages (Fig. 9.3).
- *Lymphedema*
  - Usually affects all the skin layers and appears as a thickening of the epidermis, dermis, and hypodermis with decreased echogenicity of the dermis and increased echogenicity of the hypodermis (Fig. 9.4).
  - In some cases, lymphedema can appear as blurriness or a slightly hyperechoic and heterogeneous echogenicity of the hypodermis.
  - Additionally, compressible anechoic or hypoechoic fluid with internal echoes may be detected between the fatty lobules of the hypodermis [1, 8].

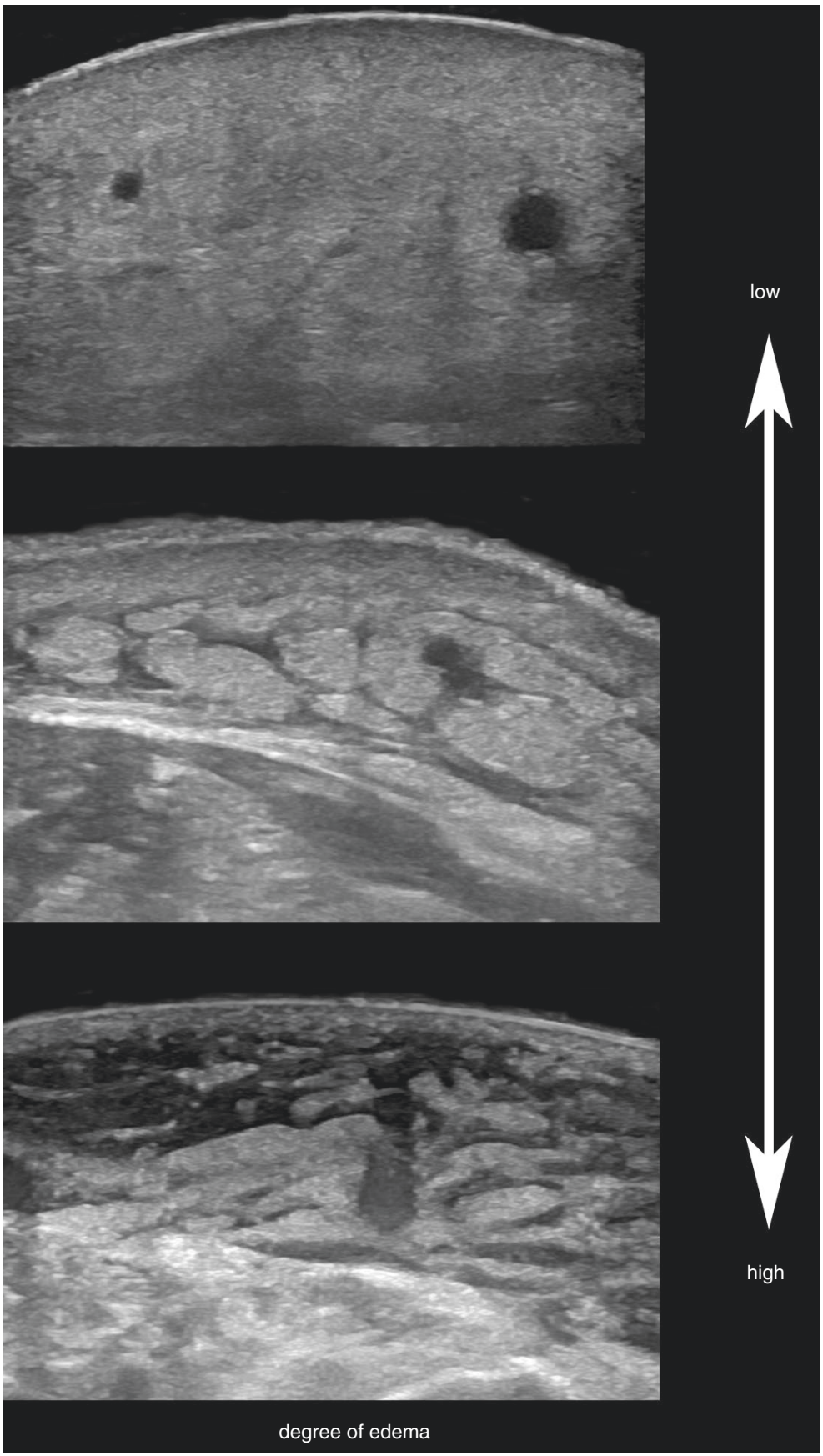


Fig. 9.3 Grading of edema in the skin layers. Notice the increase of anechoic fluid between the fatty lobules of the hypodermis.

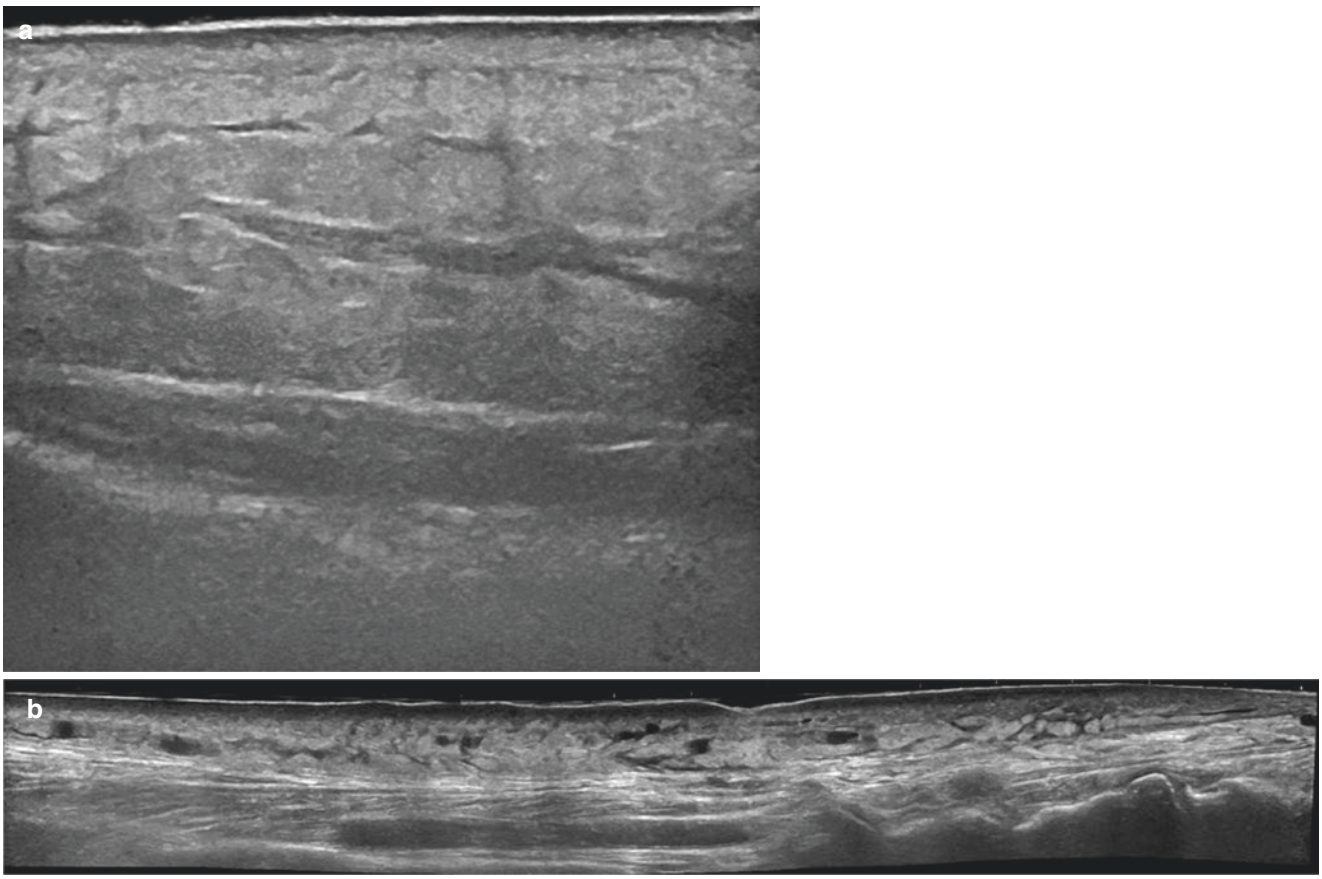


Fig. 9.4 Lymphedema. (**a**, **b**) Ultrasound (greyscale) shows thickening of the epidermis, dermis, and hypodermis. There is hypoechogenicity of the dermis and hyperechogenicity of the hypodermis. In (**a**) notice that the fluid between the fatty lobules may present higher echogenicity than with plain edema.

9.3 Panniculitis

9.3.1 Definition

Inflammation of the hypodermis. Usually, it affects both the fatty lobules and septa, but one component is often predominant. According to the predominant involvement, panniculitis can be classified as septal, lobular, or mixed [1, 9–12] (Fig. 9.5). The discrimination of the main type (septal or lobular) may support the diagnosis, but sometimes the same patient may present several lesions with different types of panniculitis, making this discrimination difficult. In addition, vasculitis is not always detected, because of the small size of the affected vessels. Nevertheless, hypoechoic inflammatory tissue and/or increased echogenicity of the hypodermal fat surrounding medium-size or large vessels may be seen on ultrasound. Table 9.1 lists the most common conditions associated with each type of panniculitis.

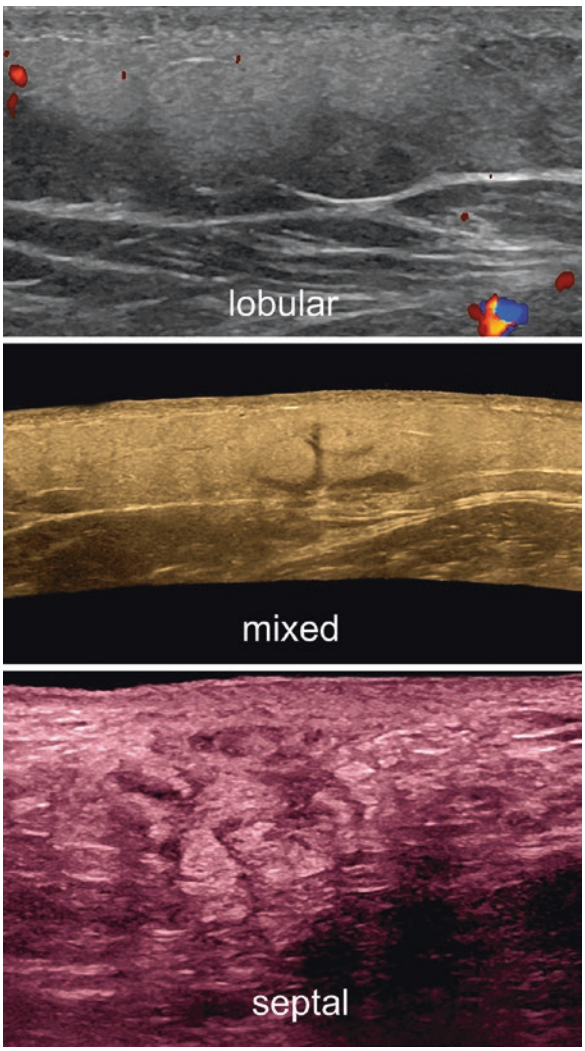


Fig. 9.5 Key sonographic signs of lobular, mixed, and septal panniculitis.

Table 9.1 Conditions most commonly associated with panniculitis

Predominantly lobular [10]	**Predominantly septal** [9]
With vasculitis	*With vasculitis*
Erythema induratum of Bazin	Leukocytoclastic vasculitis
Neutrophilic lobular (pustular) panniculitis	Superficial thrombophlebitis
Crohn's disease	Polyarteritis nodosa
Erythema nodosum leprosum	
Without vasculitis	*Without vasculitis*
Sclerosing panniculitis	Erythema nodosum
Calciphylaxis	Necrobiosis lipoidica
Sclerema neonatorum	Granulomma annulare
Cold panniculitis	Morphea/scleroderma
Lupus erythematosus profundus	Rheumatoid nodule
Dermatomyositis	Necrobiotic xanthogranuloma
Pancreatic panniculitis	
α1-Antitrypsin deficiency	
Infective panniculitis	
Factitial panniculitis	
Sarcoidosis	
Trauma	
Lipoatrophy	
Fat necrosis of the newborn	
Poststeroid panniculitis	
Gout	
Crystal-storing histiocytosis	
Cytophagic histiocytic panniculitis	
Postirradiation pseudosclerodermatous panniculitis	

9.3.2 Key Sonographic Signs

The signs that could indicate a mostly lobular, septal or mixed panniculitis are the following (Figs. 9.6–9.11).

- *Mostly lobular*
  - Increased echogenicity of the hypodermis with a diffuse and bright pattern (Figs. 9.6, 9.7, 9.8, and 9.9)
  - This appearance has been named "foggy" pattern
  - Color Doppler may show hypovascularity or hypervascularity [1, 11].
- *Mostly septal*
  - Prominent hypodermal fatty lobules that show increased echogenicity
  - Thickening and hypoechogenicity of the septa between the fatty lobules (Figs. 9.10 and 9.11) that may show low compressibility with the probe.
  - This sonographic appearance has been named "cobblestone" pattern.
  - On color Doppler, they may show hypo or hypervascularity [1, 11]
- *Mixed*
  - Present an intermediate pattern with increased echogenicity of the fatty lobules and some areas with hypoechoic prominent septa (Fig. 9.9)

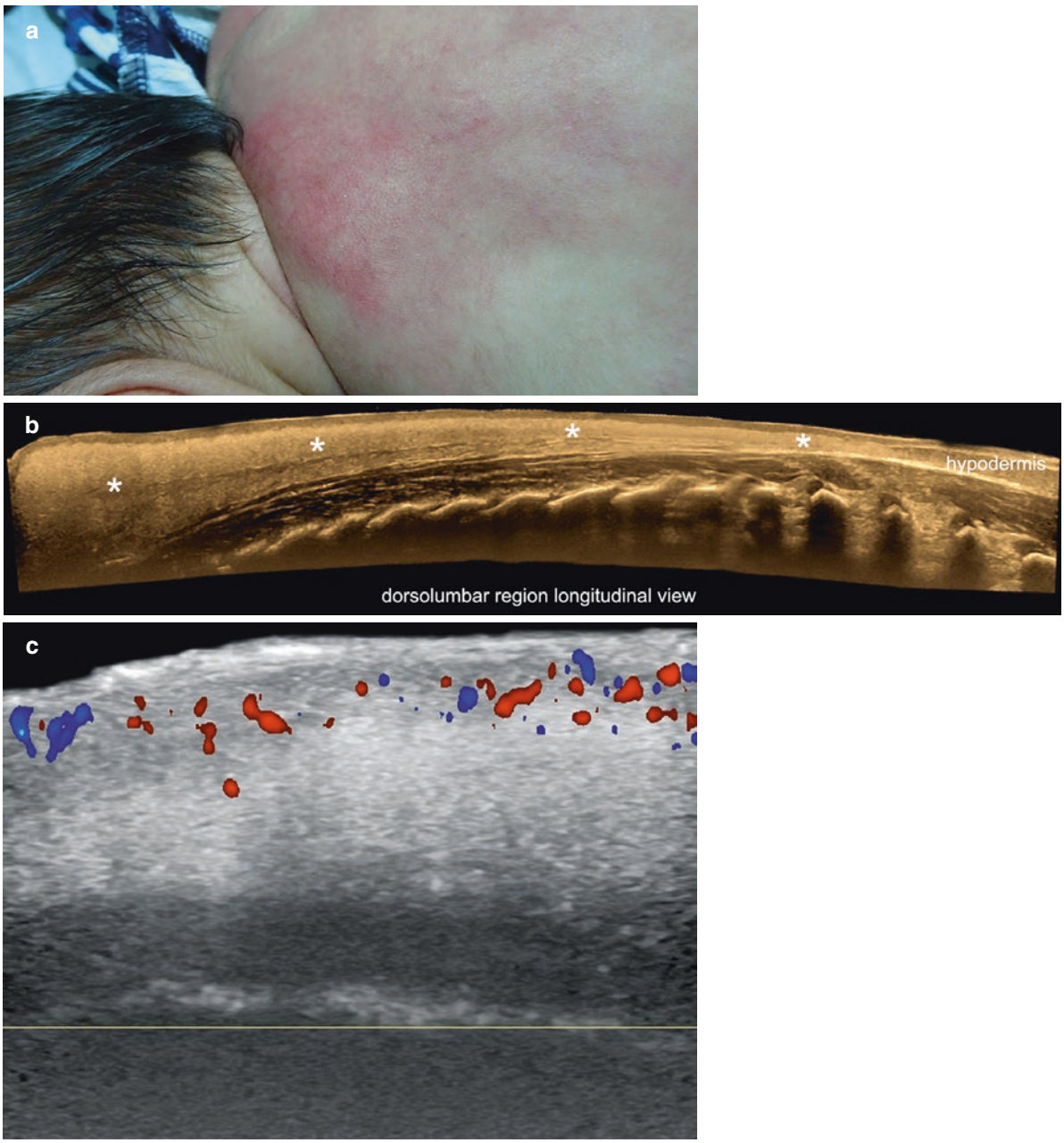


Fig. 9.6 Mostly lobular panniculitis. Fat necrosis of the newborn. (**a**) Clinical image. (**b**, **c**) Ultrasound (longitudinal views, dorsolumbar region; **b**, greyscale; **c**, color Doppler) shows a diffuse hyperechogenicity of the hypodermis (*asterisks*). On color Doppler, there is increased dermal and hypodermal vascularity. Notice the "foggy" pattern of the fatty tissue.

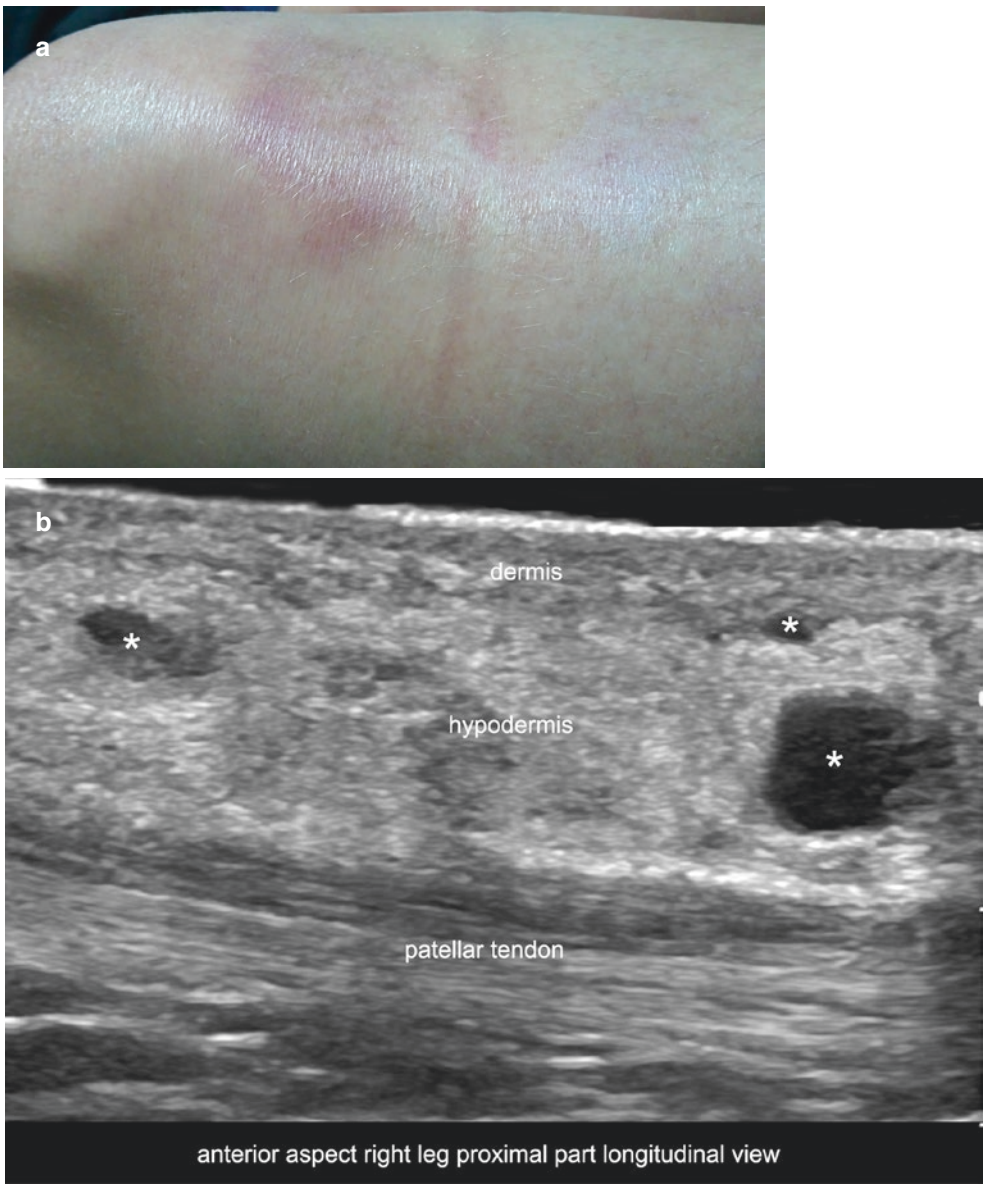


Fig. 9.7 Mostly lobular panniculitis. Fat necrosis secondary to trauma in the anterior aspect of the right knee (infrapatellar region). (**a**) Clinical image. (**b**) Greyscale, and (**c**) color Doppler ultrasound (anterior aspect of the right leg; longitudinal view) demonstrate increased echogenicity of the hypodermis. Notice the well-defined, anechoic pseudocystic structures (*asterisks*) that correspond to sites of liquefaction of the fat. On color Doppler, there is increased echogenicity of the hypodermis.

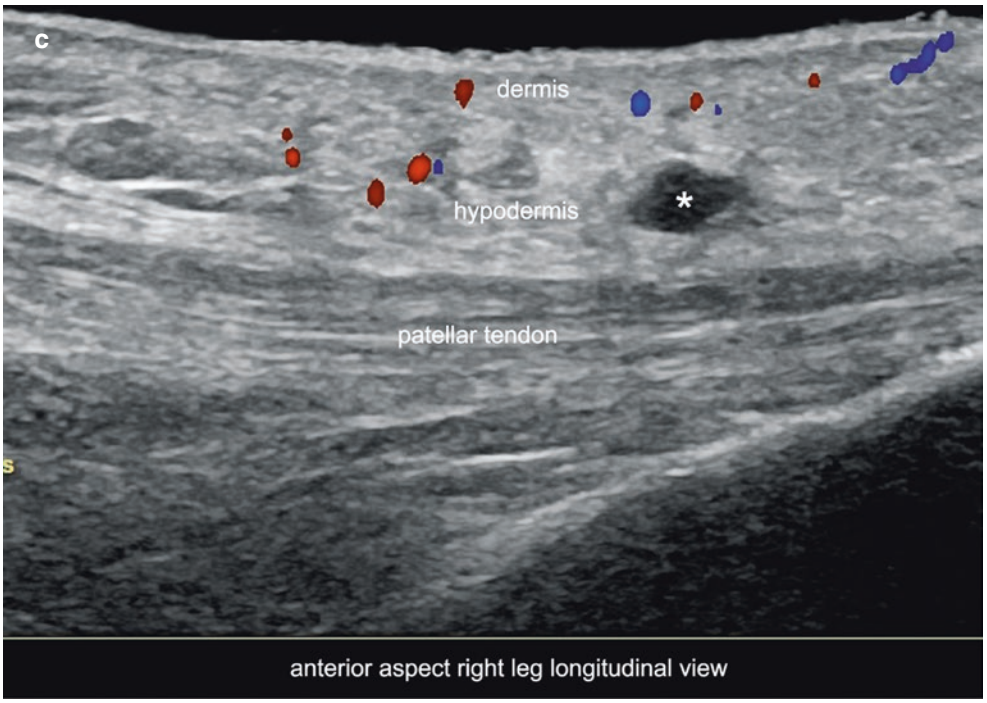


Fig. 9.7 (continued)

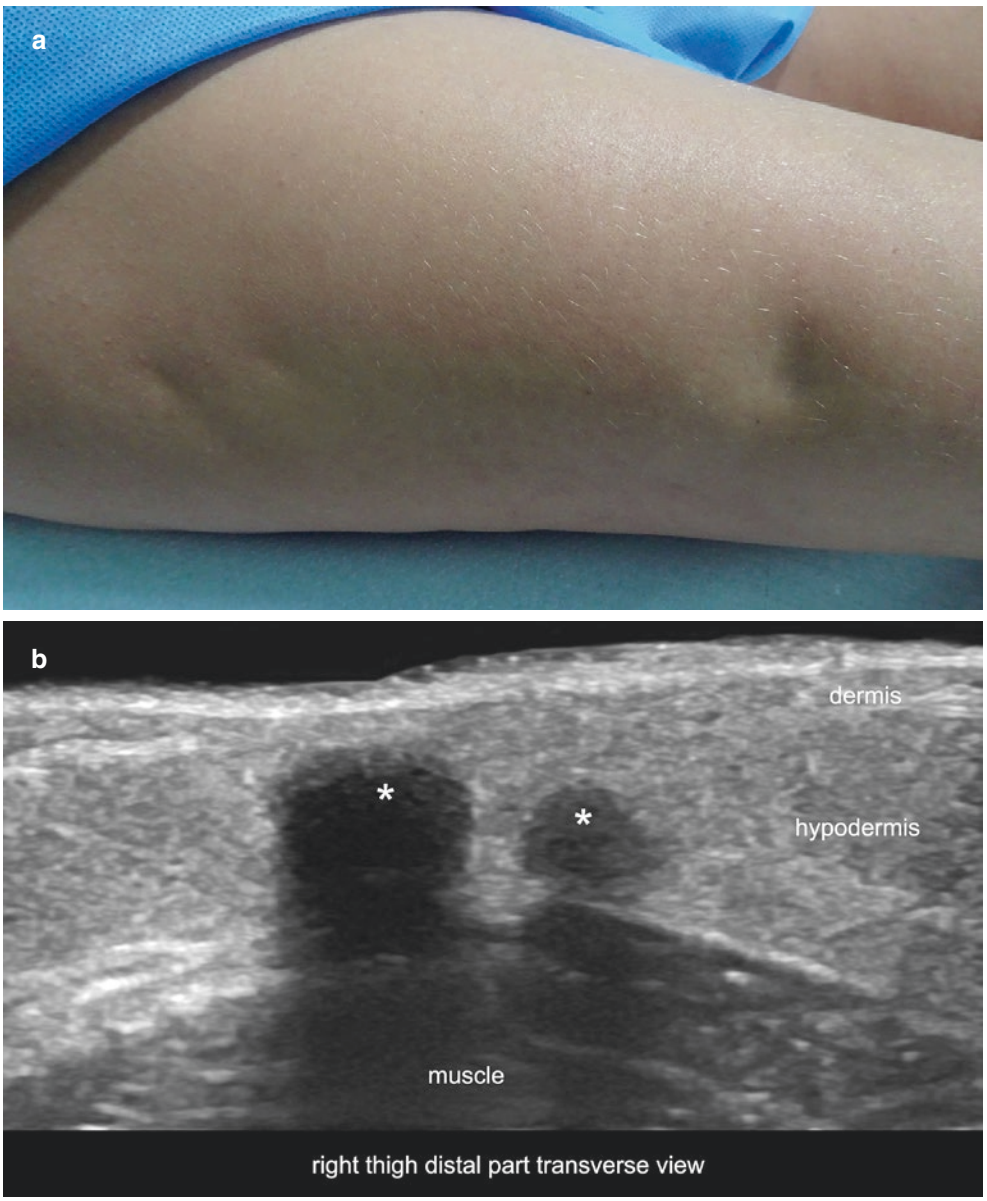


Fig. 9.8 Late calcification of fat necrosis site (mostly lobular panniculitis). (**a**) Clinical image shows areas of retraction of the skin in the lateral aspect of the right thigh. (**b**) Ultrasound (transverse view; distal and lateral aspect of the right thigh) demonstrates two hyperechoic hypodermal nodules (*asterisks*) with strong posterior acoustic shadowing artifact due to the presence of calcium. The sites of focal liquefaction of the fatty tissue may develop an "egg-shell" type of calcification. Notice the slight retraction of the epidermis and the dermal thinning on top of the calcified nodules, a result of scarring.

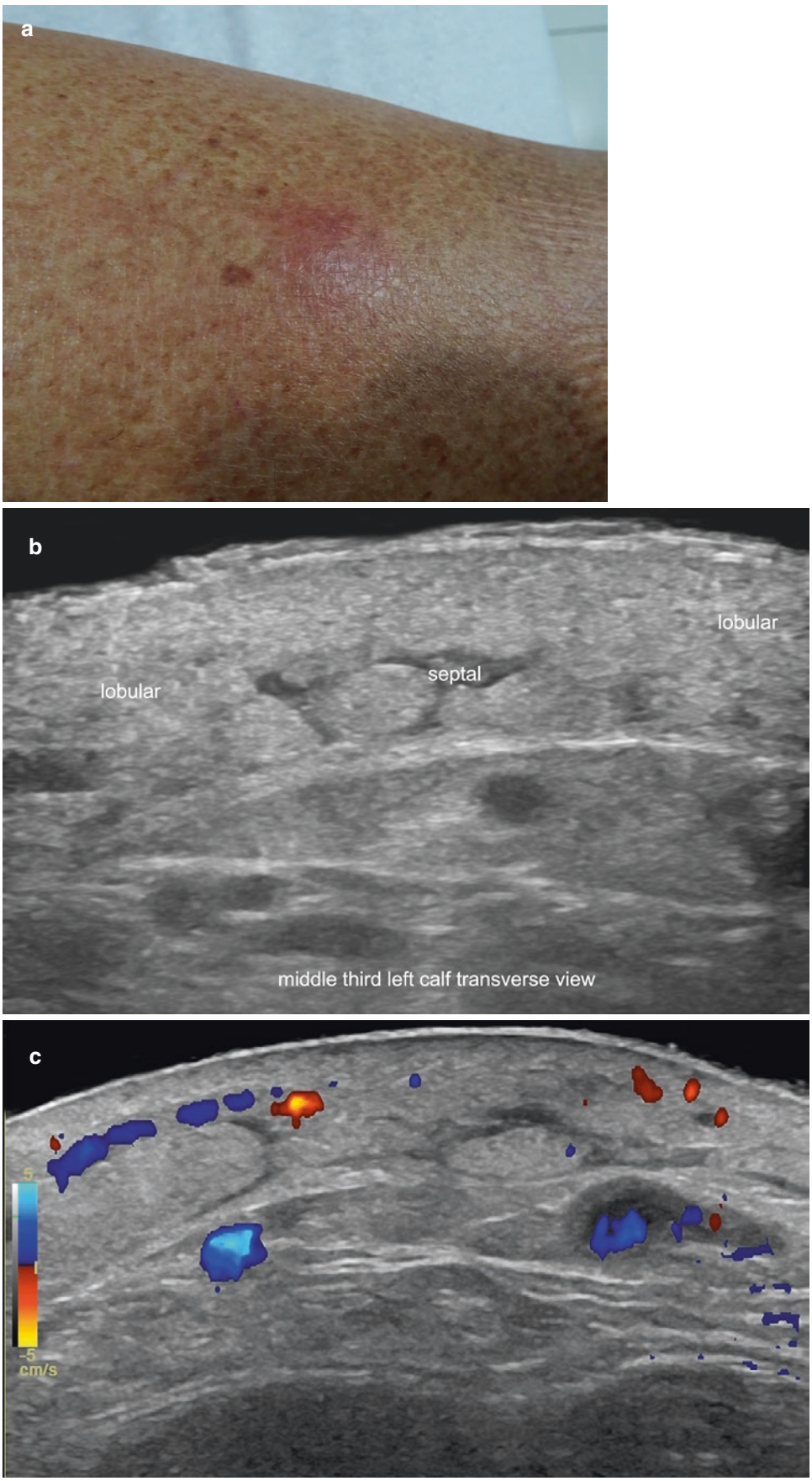


Fig. 9.9 Mixed panniculitis (infectious). (**a**) Clinical photograph. (**b**) Ultrasound (middle third of the left calf) shows increased echogenicity of the hypodermis with some areas with hypoechoic and thick septa. (**c**) Color Doppler presents increased dermal and hypodermal vascularity.

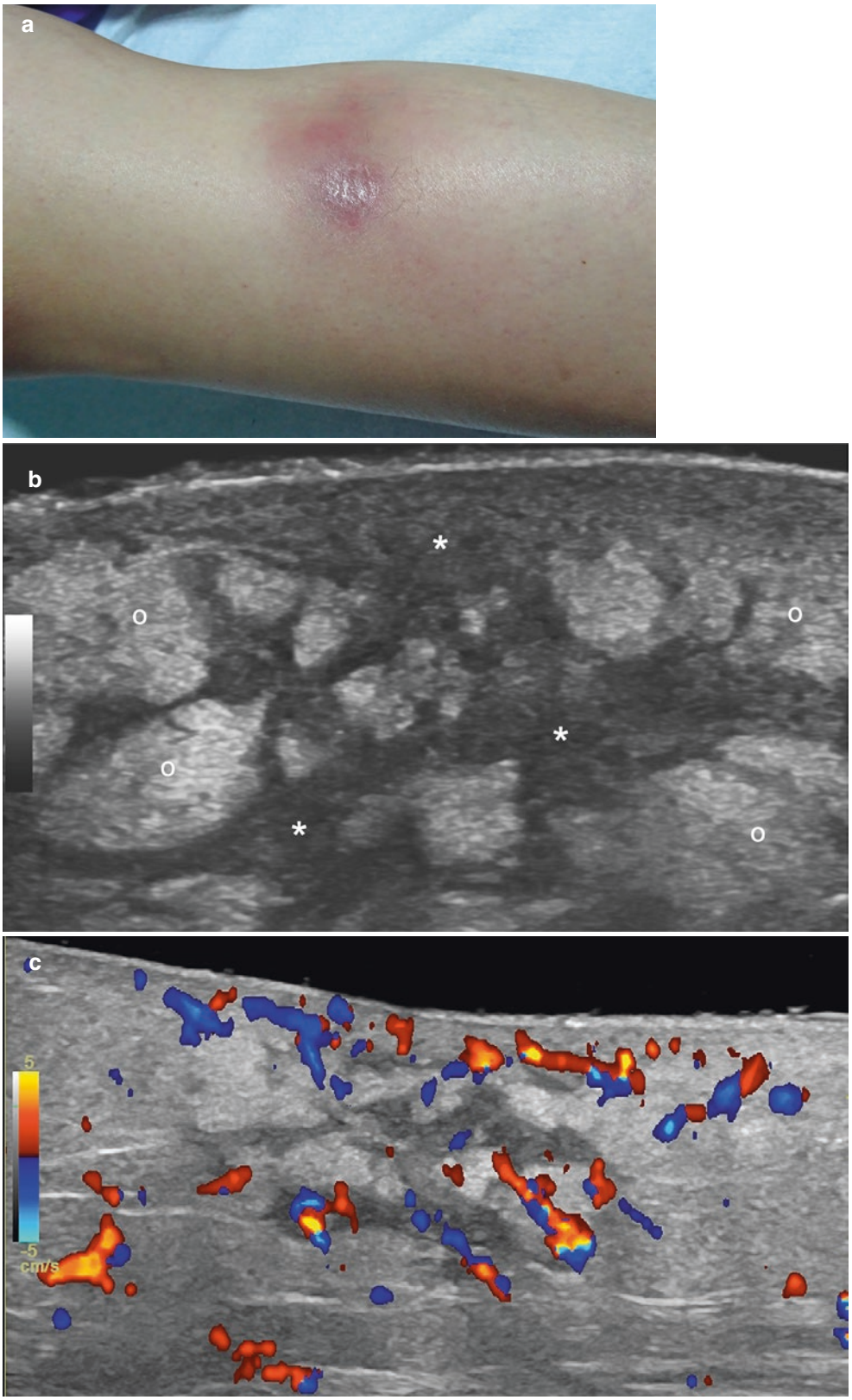


Fig. 9.10 Mostly septal panniculitis. Erythema nodosum. (**a**) Clinical image. (**b**, **c**) Ultrasound (upper and anteromedial aspect of the right leg; transverse views; (**b**) greyscale, and (**c**) color Doppler). There are prominent hyperechoic fatty lobules (*o*) and hypoechoic and thick septa (*asterisks*) in the hypodermis. The dermis on top of this site shows decreased echogenicity. Color Doppler shows dermal and hypodermal hypervascularity.

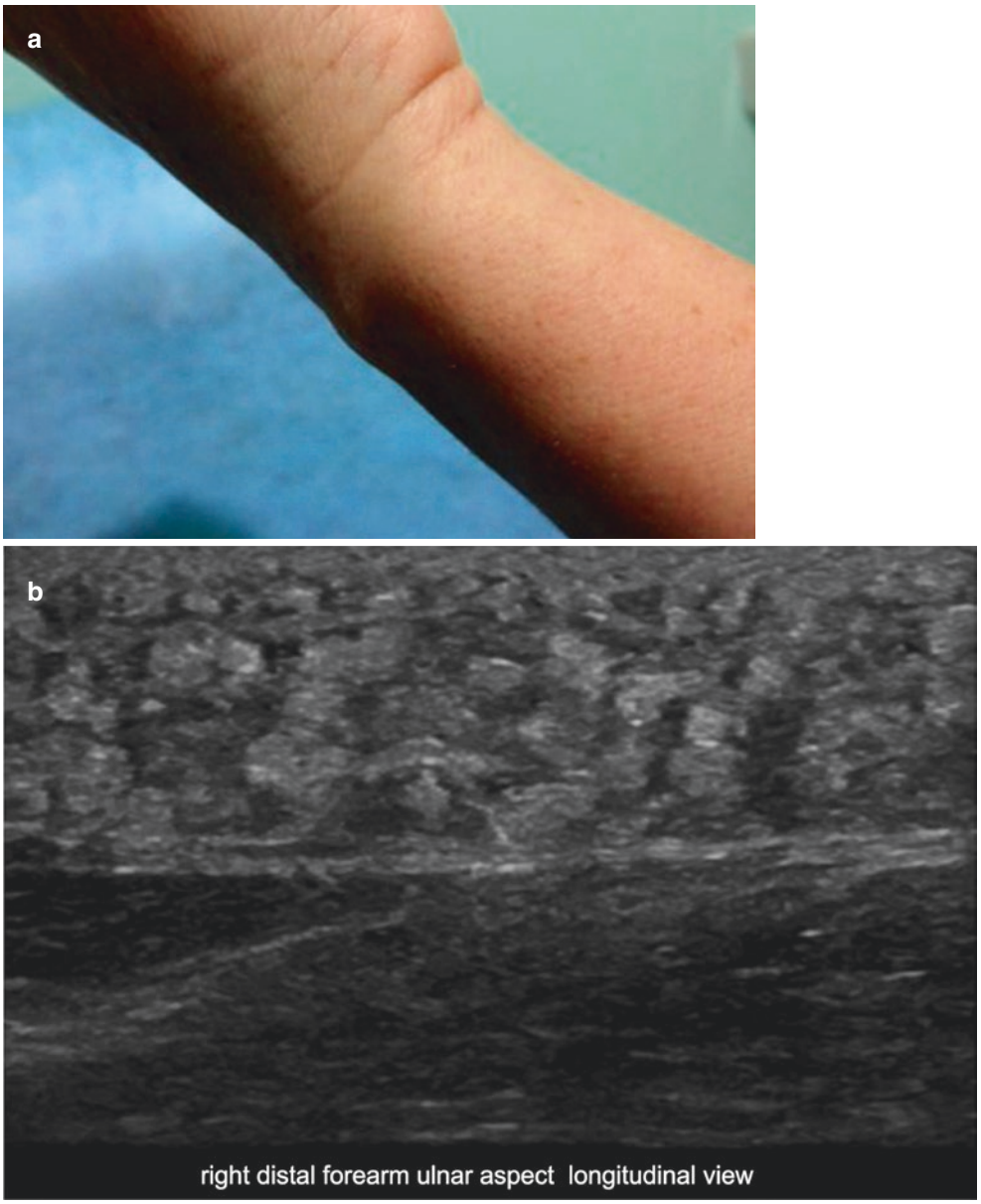


Fig. 9.11 Mostly septal panniculitis (granulomatous origin). (**a**) Clinical site of the lesion in the distal and ulnar aspect of the right forearm. (**b**, **c**) Ultrasound (longitudinal views; (**b**) greyscale, and (**c**) panoramic greyscale with color filter) demonstrates prominent hyperechoic lobules surrounded by hypoechoic and thick septa in the hypodermis (*asterisk*). (**d**) MRI (T1-weighted with gadolinium and fat suppression) shows hypodermal hyperintensity in the affected region (*arrow*), but it is not possible to discriminate the predominant type of panniculitis.

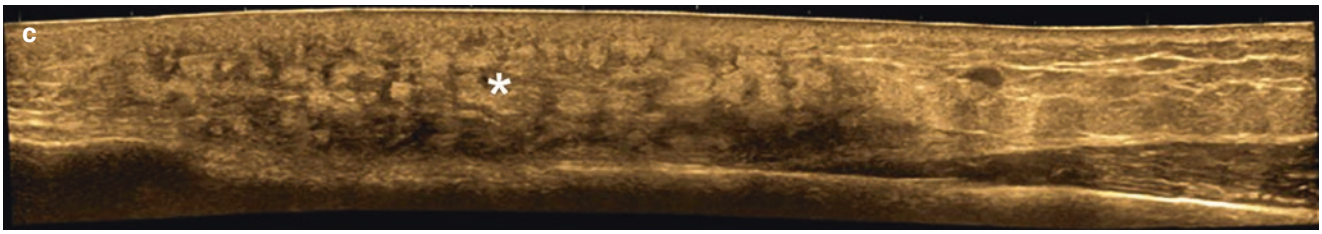


Fig. 9.11 (continued)

9.4 Cutaneous Lupus

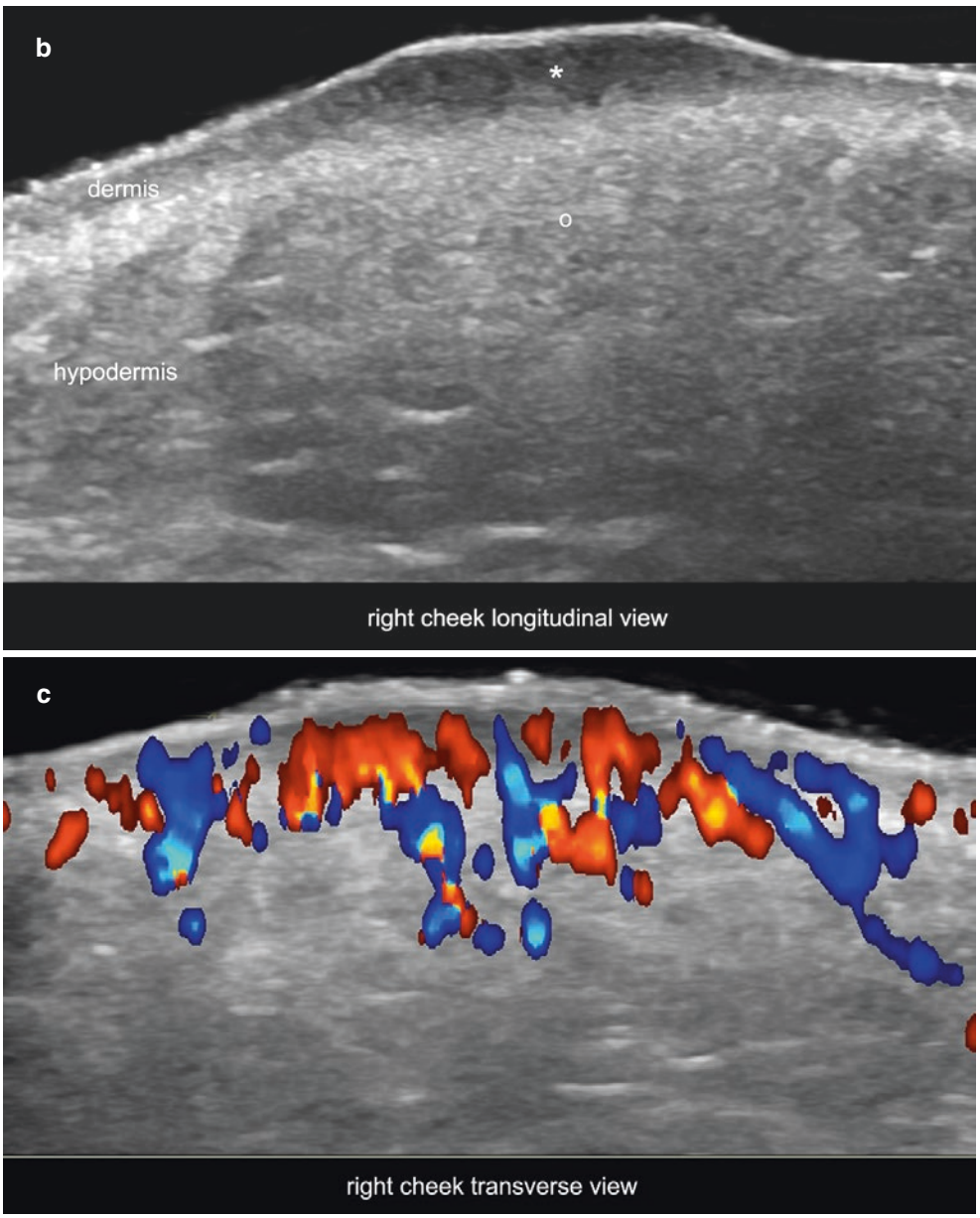
9.4.1 Definition

Autoimmune inflammatory disease that may be classified into acute, subacute, or chronic types. It can be a cutaneous manifestation of systemic erythematous lupus, or it may precede systemic involvement. Chronic cutaneous lupus erythematosus includes several subtypes, including discoid lupus erythematosus, lupus erythematosus profundus, chilblain cutaneous lupus, and lupus tumidus.

9.4.2 Key Sonographic Signs

- In the active phase, cutaneous lupus tends to show thickening and hypoechogenicity of the dermis and increased echogenicity of the upper hypodermis. The dermal affection frequently presents a fusiform or plateau shape (Fig. 9.12). The most commonly affected region is the face, particularly the malar or cheek regions. On color Doppler, a variable degree of lesional blood flow may be seen that could vary from hyper to hypovascularity according to the level of activity.
- Chronic forms of cutaneous lupus such as discoid lupus present atrophy of the cutaneous layers and hypovascularity.
- Lupus can show a prominent and deep, mostly lobular type of panniculitis, also called lupus erythematous profundus (Fig. 9.13) or lupus panniculitis. This type of involvement is more commonly seen as a cutaneous manifestation of the systemic form of involvement. On ultrasound, this type of lupus may show a mixed pattern of panniculitis, with some areas with mostly lobular involvement that show diffuse thickening and hyperechogenicity of the hypodermis ("foggy" pattern). Other sites may present a mixed panniculitis or mostly septal involvement with prominent thickening and hypoechogenicity of the hypodermal septa ("cobblestone" pattern). On color Doppler, this type of involvement can present dermal and/or hypodermal hypovascularity or hypervascularity according to the level of activity of the disease.
- Lupus patients may show thinning and beading of the lumen of the arteries due to autoimmune inflammation and endothelial damage, which can cause Raynaud's phenomenon and ischemia with partial or total occlusion of vessels, which is most commonly seen in the arteries of the fingers [1, 13, 14].

Fig. 9.12 Cutaneous lupus. Active phase**.** (**a**) Clinical photograph of the right malar region. (**b**, **c**) Ultrasound (right malar region; transverse view; (**b**) greyscale, and (**c**) color Doppler) shows focal thickening and hypoechogenicity of the dermis (*asterisk*) with a plateau shape. Increased echogenicity of the upper hypodermis with a "foggy pattern" is also detected. Color Doppler shows prominent vascularity in the dermis and hypodermis.



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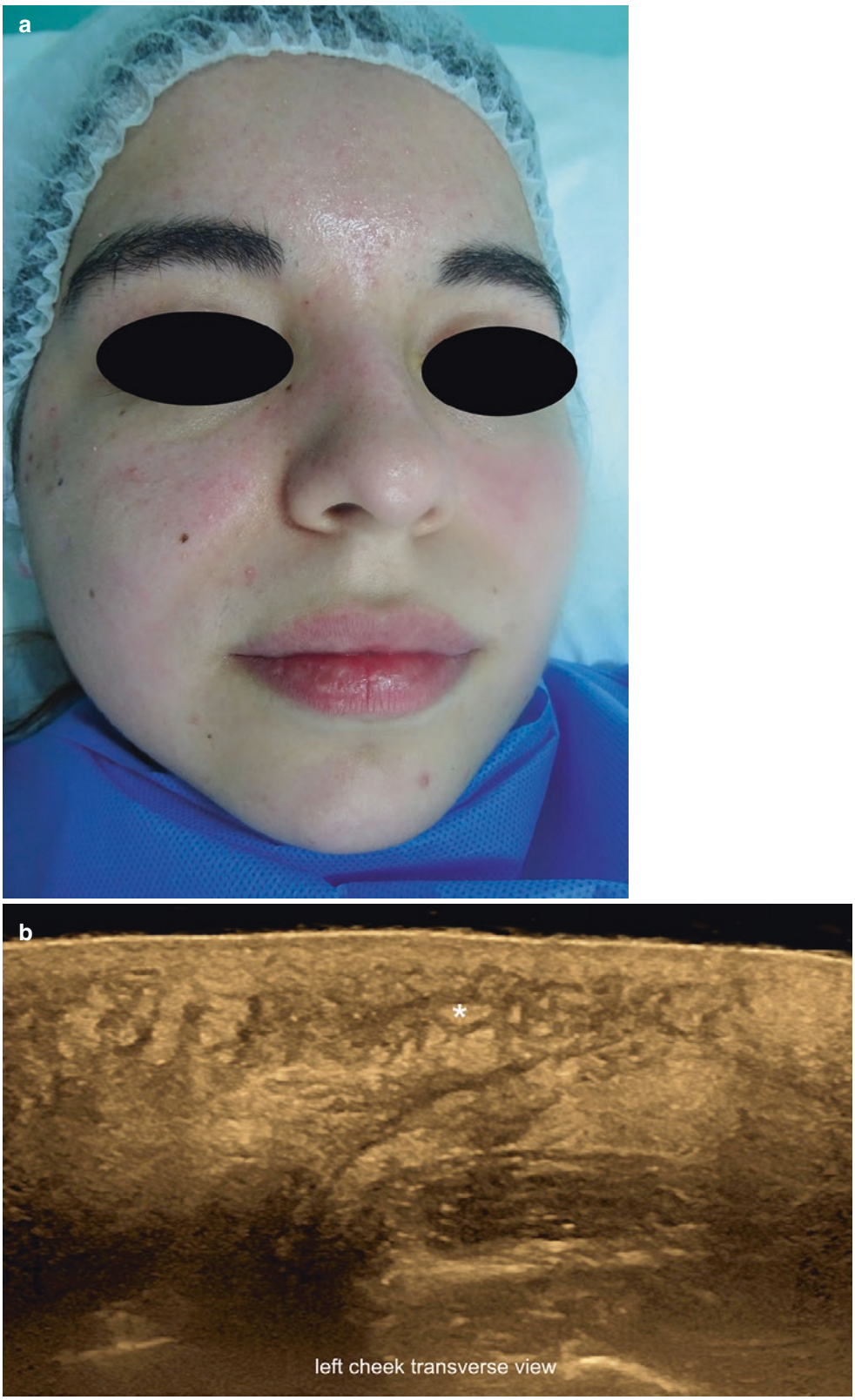


Fig. 9.13 Lupus profundus. (**a**) Clinical photograph. (**b**) Ultrasound (greyscale with color filter; left cheek; transverse view) shows a mostly septal type of panniculitis ("cobblestone" pattern) in the hypodermis of the left upper cheek (*asterisk*). (**c**) Color Doppler (left mandibular region; transverse view) demonstrates a mostly lobular panniculitis ("foggy" pattern) in the hypodermis (*asterisk*) at the lower part of the cheek. There is also thickening and decreased echogenicity of the dermis in this area. Notice the slight hypervascularity in the border of the dermis and hypodermis.

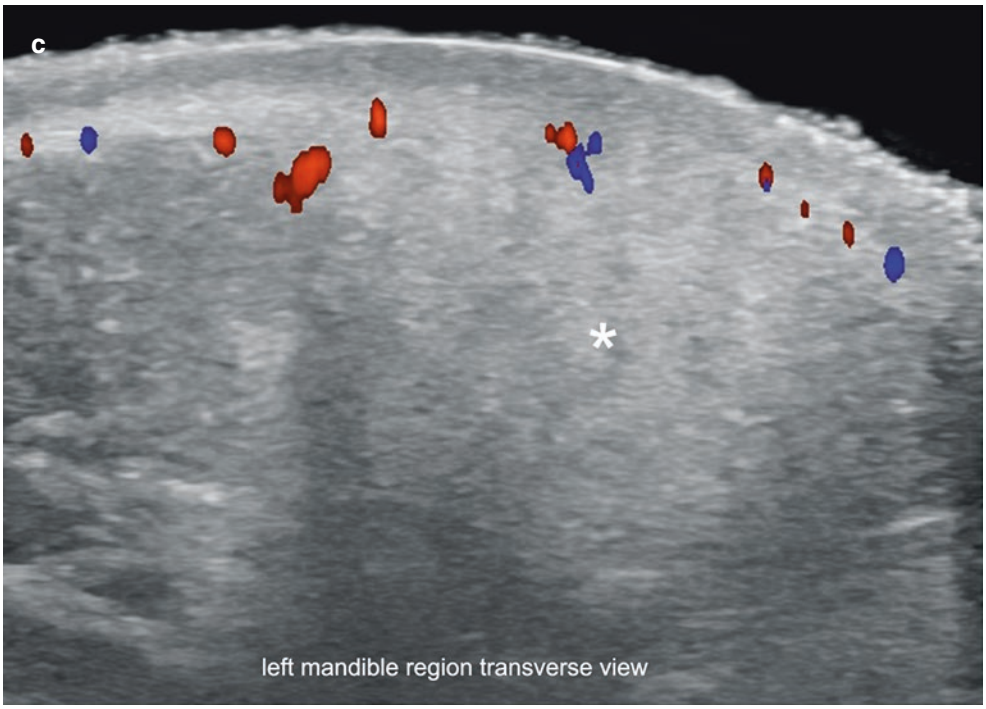


Fig. 9.13 (continued)

9.5 Dermatomyositis

9.5.1 Definition

Autoimmune inflammatory disease that mainly affects the skin and the skeletal muscles and lungs

Fig. 9.14 Dermatomyositis. (**a**) Clinical photograph. (**b**) Color Doppler ultrasound (left cheek; longitudinal view) shows Increased echogenicity and thickening of the hypodermis (mostly lobular panniculitis), thickening and hypoechogenicity of the dermis, and increased dermal and hypodermal vascularity. (**c**) Ultrasound (greyscale; side-by-side comparison of the sternocleidomastoid muscles) demonstrates increased echogenicity with some hyperechoic areas in the left sternocleidomastoid muscle. (**d**) Color Doppler ultrasound (side-by-side comparison; transverse views of sternocleidomastoid muscles) shows increased vascularity within the left sternocleidomastoid muscle.

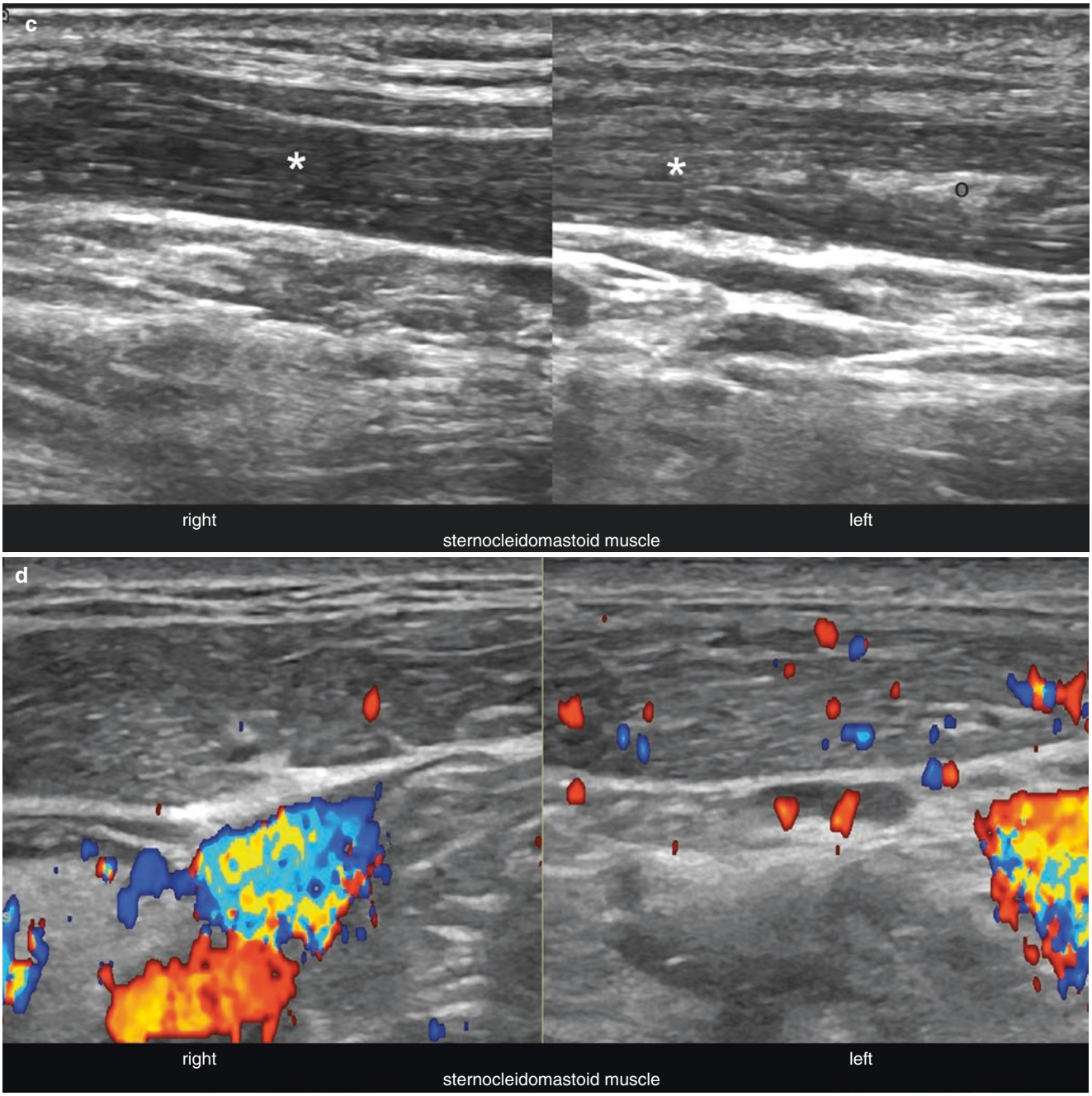


Fig. 9.14 (continued)

9.5.2 Key Sonographic Signs

- Increased echogenicity of the hypodermis (mostly lobular pattern of panniculitis)
- Increased echogenicity of the muscles, which could show patchy, partial, or diffuse types of intramuscular involvement (Fig. 9.14)
- Hyperechoic hypodermal calcium deposits with posterior acoustic shadowing, also called calcinosis, can be detected. These deposits can appear isolated or can present as large, plaque-like deposits that cover wide areas (Fig. 9.15).
- On color Doppler, the vascularity of the hypodermis and muscles can vary from hypovascularity to hypervascularity according to the level of activity and type of involvement of the disease [1, 15].

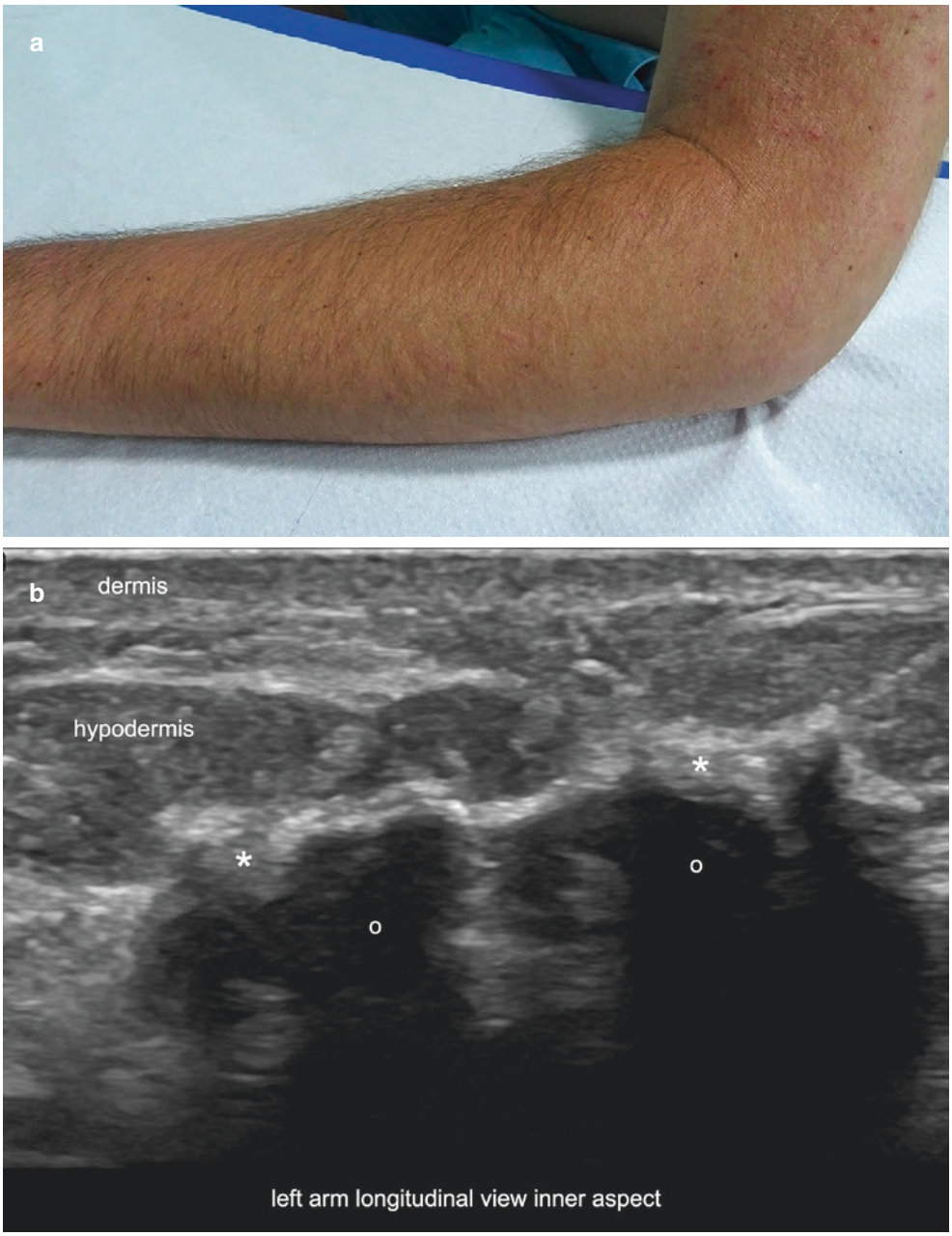


Fig. 9.15 Calcinosis in dermatomyositis. (**a**) Clinical image. (**b**) Ultrasound (greyscale; anteromedial aspect of the left arm; longitudinal view) shows hyperechoic calcified hypodermal plaque (*asterisks*), which generates strong posterior acoustic shadowing artifact (*o*).

9.6 Morphea

9.6.1 Definition

Localized cutaneous form of scleroderma [16, 17]. Morphea is an autoimmune inflammatory disease of the connective tissue characterized by the overproduction of collagen. It has different phases, beginning with an inflammatory active stage and ending with an atrophic, usually hyperpigmented phase. There are several types and subtypes [18, 19] (Table 9.2). Ultrasound has been proved useful for showing the actual extent and activity of the disease, which can vary from an inflammatory, active phase to an atrophic, inactive phase [1, 20–25].

9.6.2 Relevant Sonographic Concepts in Morphea

- Different lesions can show asynchronous activity in the same patient, with some active and others inactive.
- A single plaque may show asynchronous areas of activity, such as an atrophic and inactive area in the center and active areas at the borders.
- The presence of clinical atrophy does not mean inactivity; sonographic signs of activity may be detected in these lesions.
- The sonographic alterations of morphea should not be confused with the presence of decreased echogenicity of the skin produced by photoaging. The latter condition generates a hypoechoic band in the upper dermis called SLEB (subepidermal low echogenic band) in the corporal regions with skin exposed to the sun. In contrast with morphea, photoaging affects the superficial part of the dermis and there are no significant changes of the dermal thickness

Table 9.2 Types and subtypes of morphea [18, 19]

Clinical types	Subtypes	Variants
More frequent		
Localized or circumscribed plaque-like	Superficial	
	Deep	Subcutaneous
		Eosinophilic fasciitis (*ie*, fascial involvement)
Generalized (>2 anatomical regions)		
Linear	Head/neck	"En coup du sabre" (usually face and scalp)
	Trunk/limbs	
Pansclerotic		
Mixed		
Less frequent		
Superficial plaque-like		
Guttate morphea		
Atrophoderma of Pasini and Pierini		
Lichen sclerosus et atrophicus		
Keloid morphea (nodular morphea)		
Localized		
Progressive facial hemiatrophy (Parry-Romberg syndrome)		
Generalized		
Bullous morphea		

9.6.3 Key Sonographic Signs

- *Activity signs (inflammatory signs)*
  - Blurriness of the dermal-hypodermal border (Fig. 9.16)
  - Areas of increased echogenicity in the hypodermis (Figs. 9.17, 9.18); these can show a localized, patchy, or diffuse pattern.
  - On color Doppler, increased dermal and/or hypodermal vascularity (Fig. 9.19)
- *Other morphea sonographic signs*
  - Thickening and decreased echogenicity of the dermis. The alteration of the dermal echogenicity is usually not used for tracking activity because these alterations may be less specific and can be caused by other dermal inflammatory conditions.
  - In presence of prominent hypodermal involvement, the sonographic signs of panniculitis can vary from mostly lobular to mostly septal.
  - In atrophic stages, decreased thickness and increased echogenicity of the dermis can be seen, as well as decreased thickness or lack of fatty hypodermal tissue (Figs. 9.20 and 9.21). Color Doppler can show dermal and/or hypodermal hypovascularity in atrophic phases.
  - Involvement of the fascia may appear as blurriness or thickening and decreased echogenicity of the fascial layer. These findings frequently occur concomitantly with increased echogenicity of the adjacent hypodermis.
  - Occasionally, the involvement of the underlying muscles is detected, which can appear as localized, patchy, or diffuse areas of increased echogenicity of the muscle(s) sometimes with increased vascularity (Fig. 9.18). The presence of inflammatory muscular signs may indicate a more severe form or a mixed connective tissue disease.

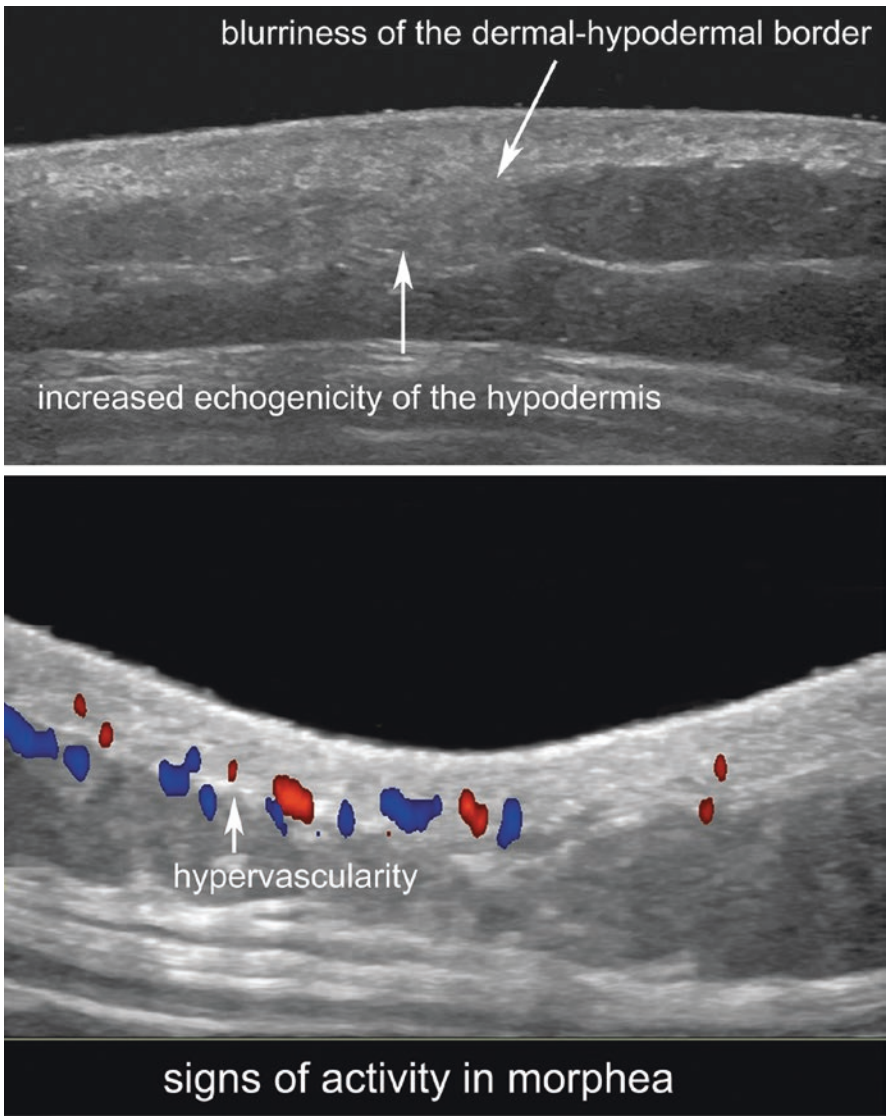


Fig. 9.16 Sonographic signs of activity in morphea.

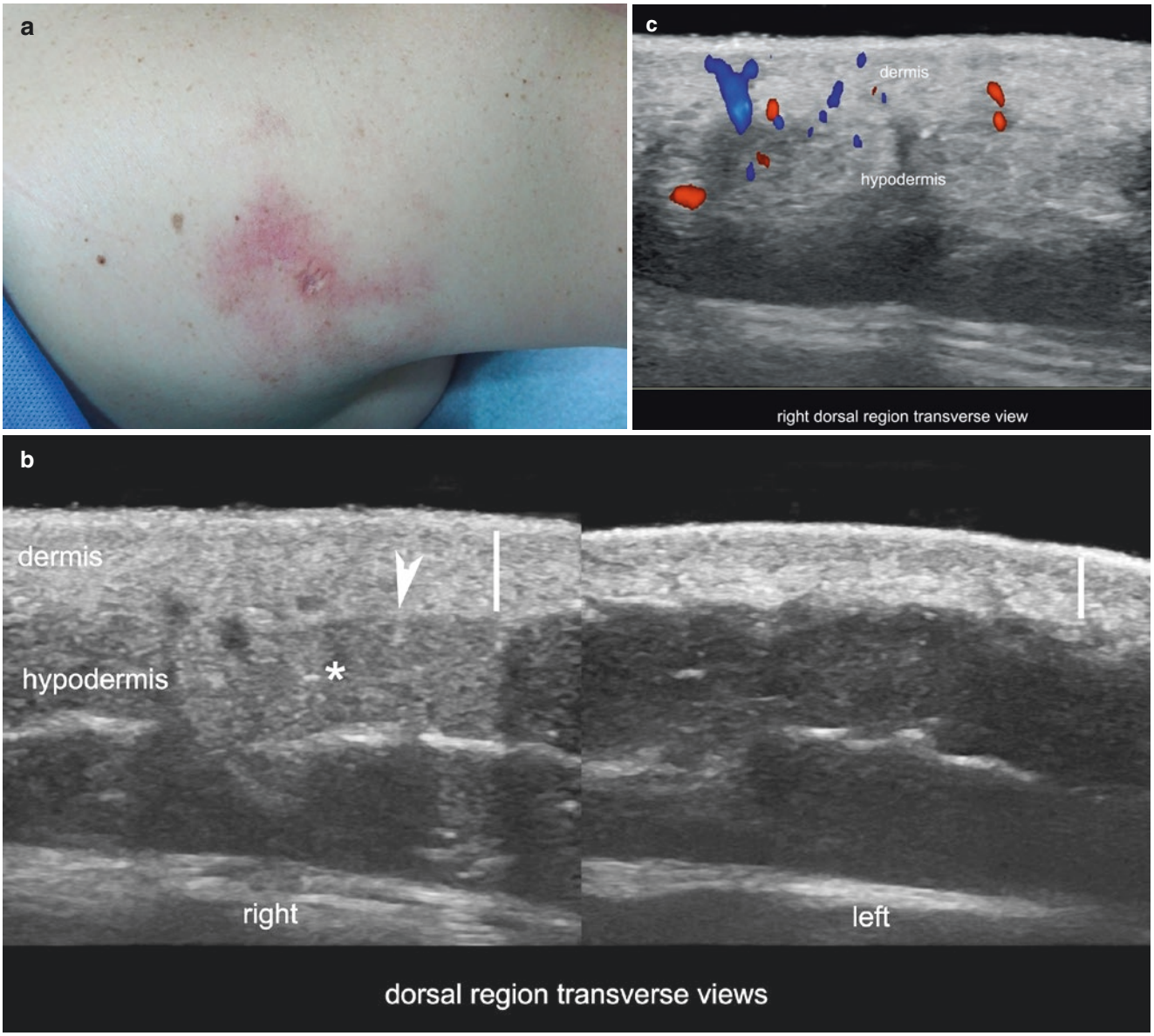


Fig. 9.17 Active morphea. (**a**) Clinical image. (**b**) Ultrasound (comparative side-by-side greyscale; right, lesional; left, normal; transverse views, dorsal region) shows blurriness of the dermal-hypodermal border (*arrowhead*) and a focal site with increased echogenicity of the hypodermis (*asterisk*). Notice the increased dermal thickening of the lesional site in comparison with the normal skin (*vertical white bands*). (**c**) Color Doppler demonstrates dermal and hypodermal hypervascularity in the lesional site.

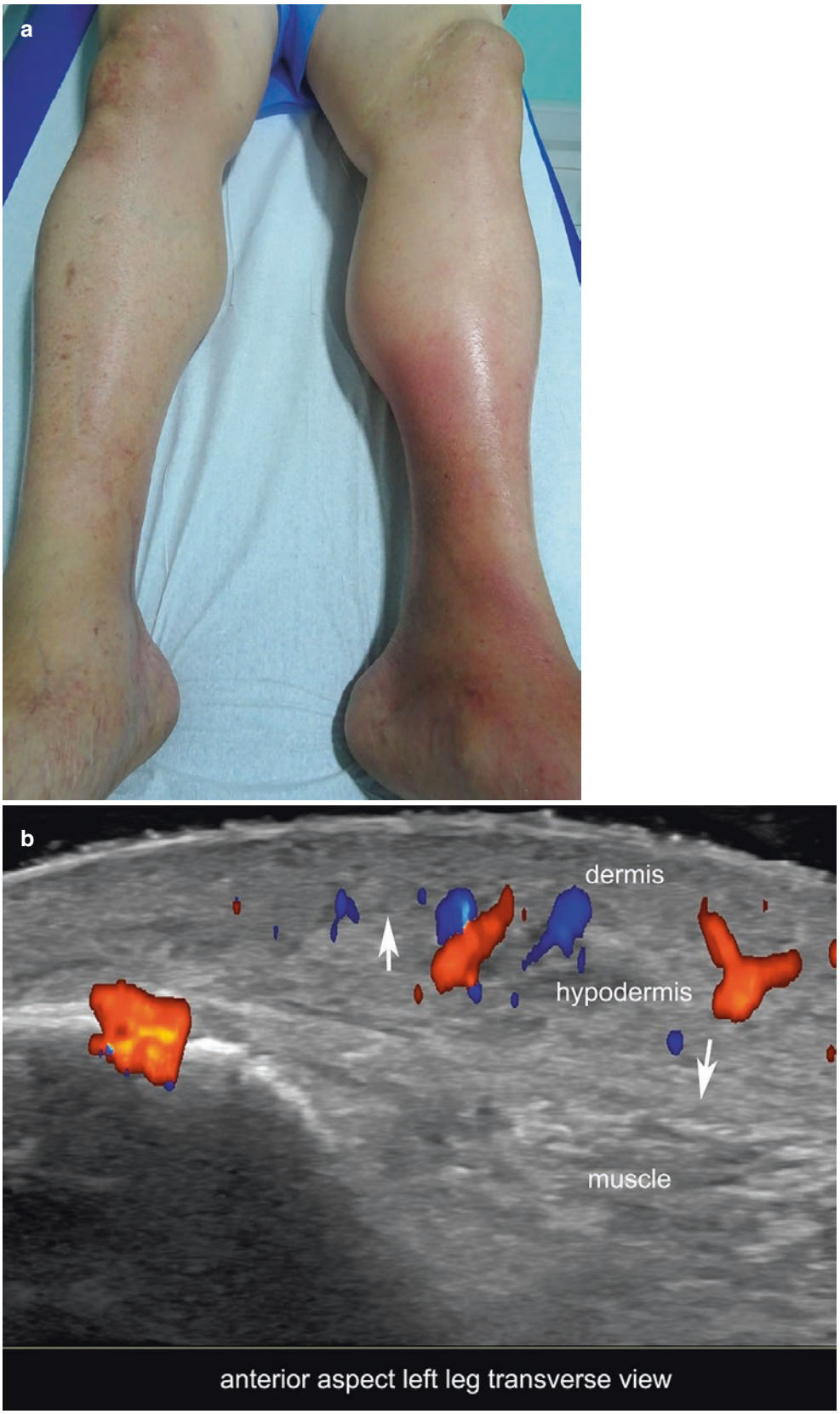


Fig. 9.18 Active deep morphea. (**a**) Clinical photograph. (**b**) Color Doppler ultrasound (transverse view; anterior aspect of the left leg) shows blurriness of the dermal-hypodermal border (*arrow pointing up*), increased echogenicity of the hypodermis, and increased dermal and hypodermal vascularity. The dermis shows decreased echogenicity and there is blurriness of the fascial layer (*arrow pointing down*) and increased echogenicity of the muscle.

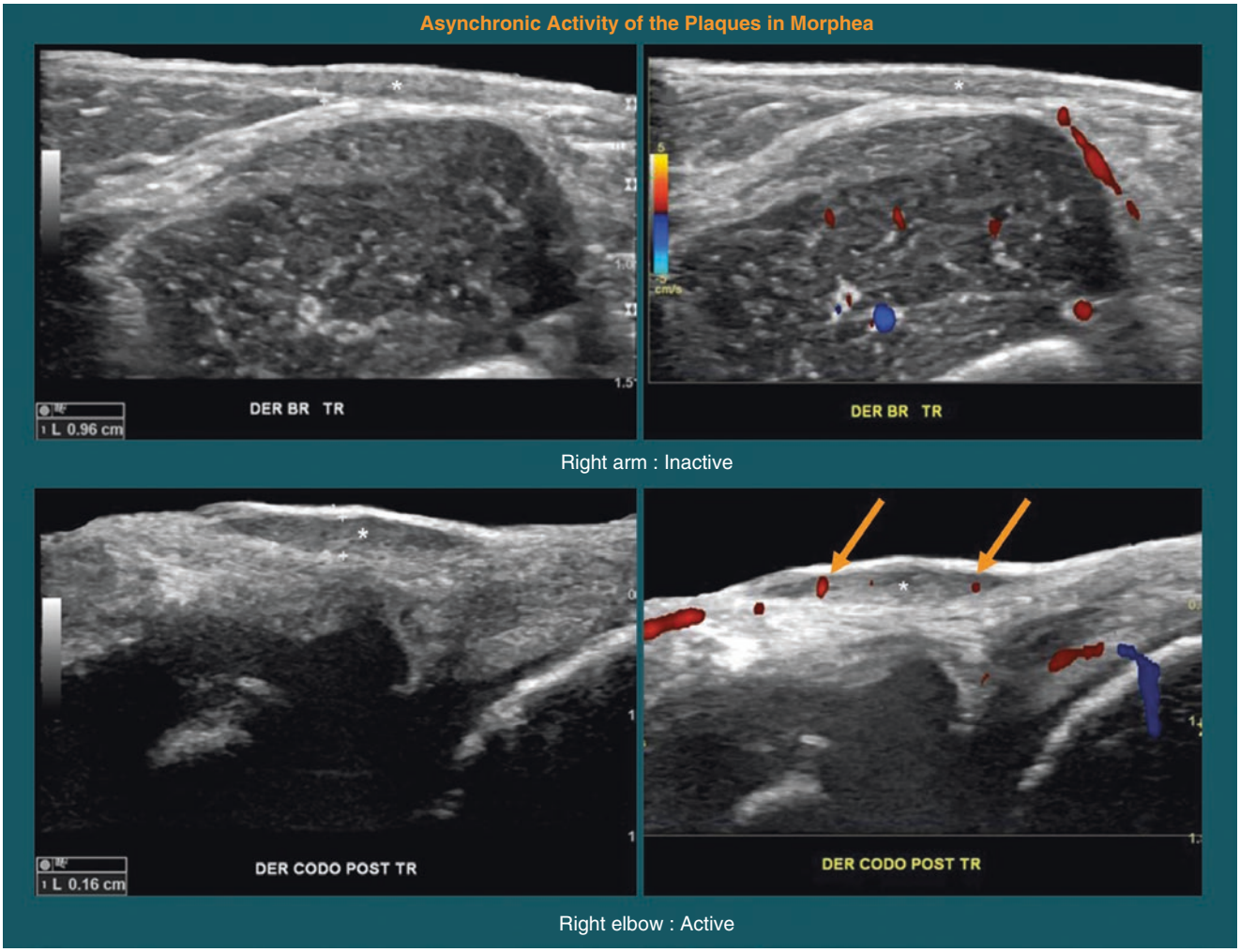


Fig. 9.19 Asynchronicity of activity in different morphea plaques in the same patient. The right arm shows an inactive lesion with thickening and decreased echogenicity of the dermis. The right elbow demonstrates an active lesion that presents hypervascularity within a focal site of thickening and decreased echogenicity of the dermis.

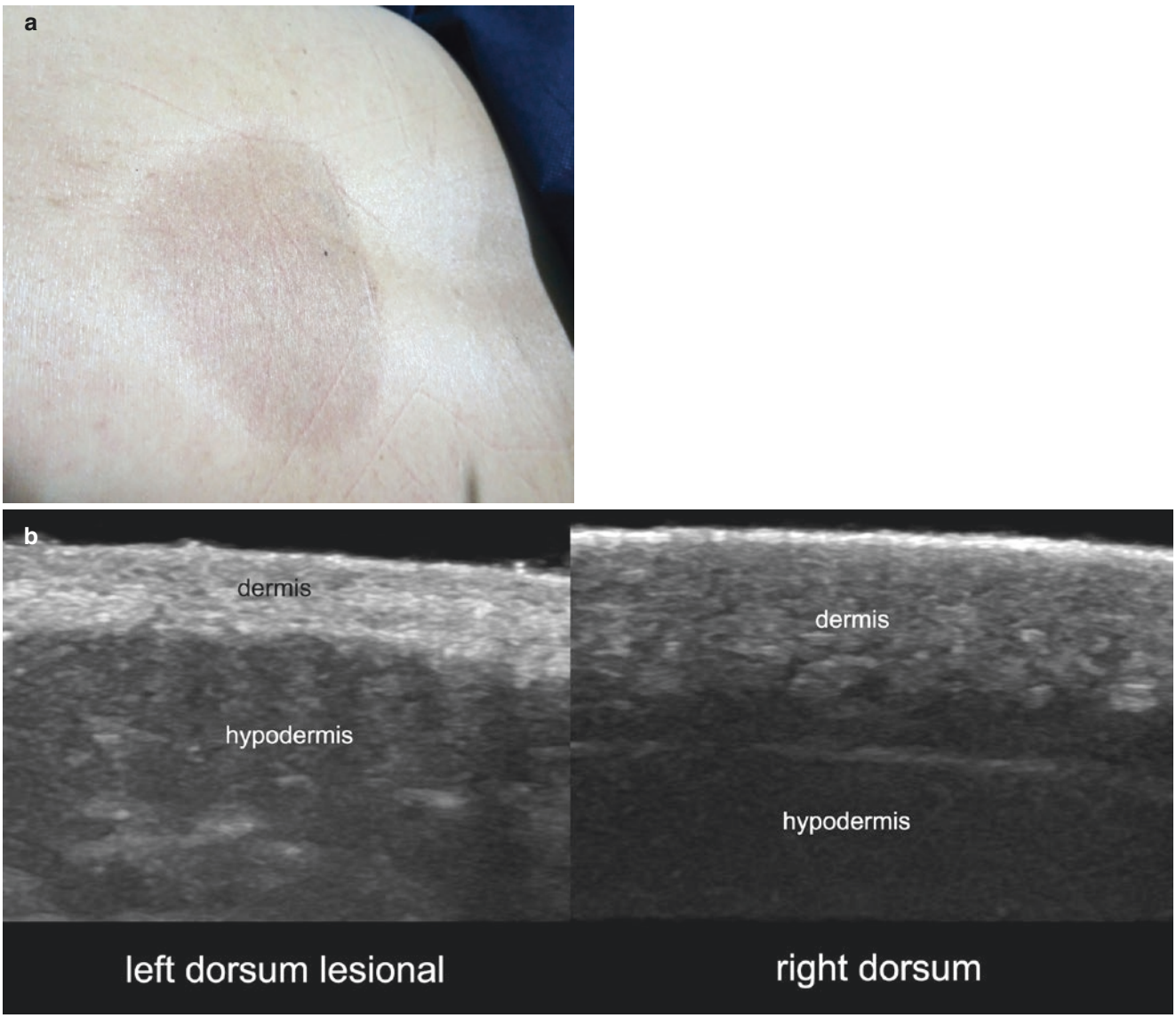


Fig. 9.20 Inactive atrophic morphea. (**a**) Clinical image. (**b**) Ultrasound (greyscale; comparative side-by-side transverse views of the dorsal region; left, lesional; right, normal) demonstrates decreased thickness and increased echogenicity of the dermis at the lesional site. Notice that the dermal-hypodermal border is well defined in the lesion area. On color Doppler (not shown) there were no signs of hypervascularity within the lesion.

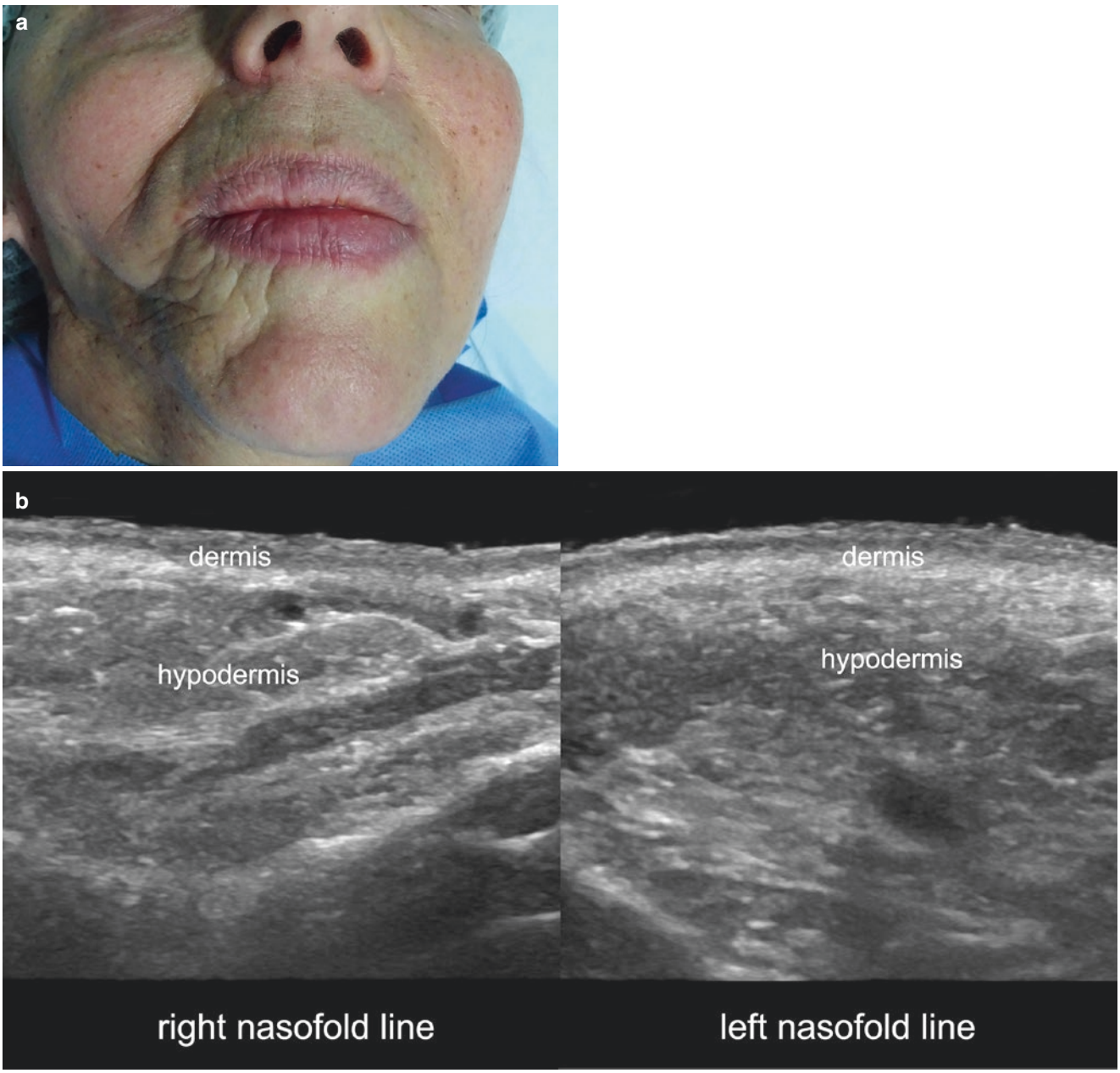


Fig. 9.21 Morphea with progressive facial hemiatrophy (Parry-Romberg syndrome). (**a**) Clinical photograph of a patient that present involvement of the right side of the face. (**b**) Ultrasound (greyscale; comparative side-by-side transverse views at the nasofold lines) shows decreased thickening of the dermis and hypodermis in the lesional side. (**c**) Color Doppler ultrasound of the parotid region (side-by-side comparison, longitudinal views) demonstrates increased vascularity, slightly decreased echogenicity and reduced size of the right parotid gland.

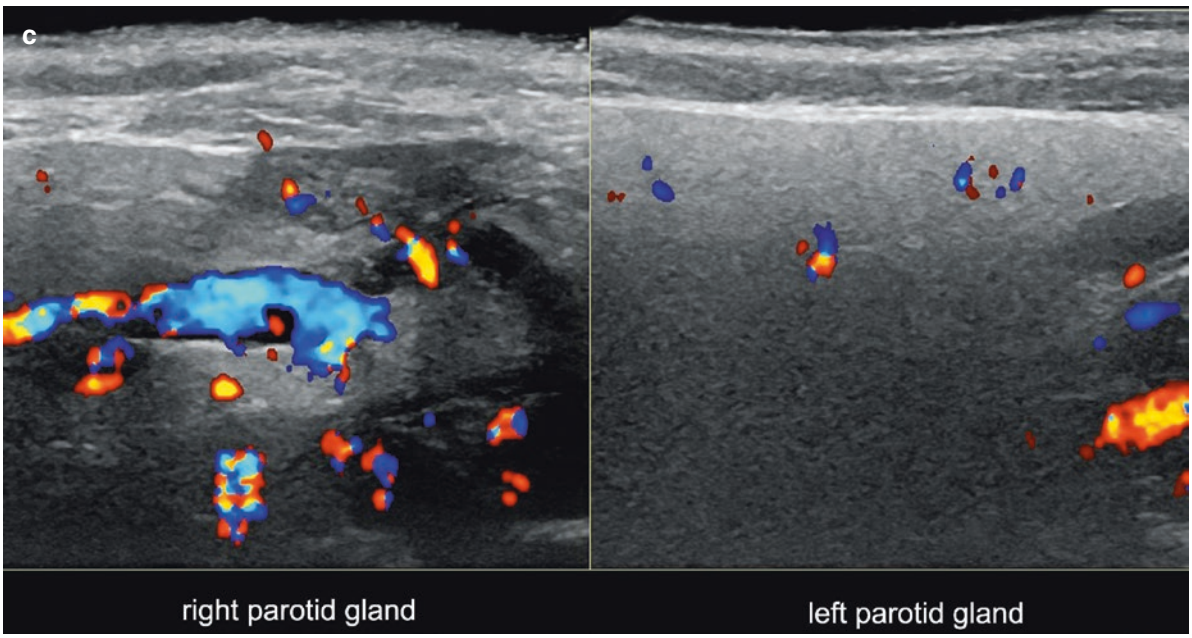


Fig. 9.21 (continued)

9.6.4 Recommendations on How to Scan Morphea Patients

- Perform a sonographic sweep of the lesion(s), including the center and the borders in at least two perpendicular axes.
- Use greyscale and color Doppler; then confirm the presence of vessels with spectral curve analysis, which can rule out the presence of colors on the screen that are due to movements of the patient (for example, breathing or crying)
- Compare the lesional site(s) with the perilesional and/or contralateral region(s).
- Check the echostructure of the skin and deeper layers such as the fascia and muscles.

9.7 Psoriasis

9.7.1 Definition

Autoimmune inflammatory disease that affects the skin with erythematous, scaly plaques. This disease also can affect the nails, tendons, joints and bony margins [1, 26, 27].

9.7.2 Key Sonographic Signs

The disease can appear in an isolated site, or a patient may show varying degrees of involvement in different areas. The main ultrasound findings can be separated according to the various targets of the disease (Figs. 9.22, 9.23, 9.24, 9.25, 9.26, and 9.27) [1, 26–42]:

- Skin
  - Thickening of the epidermis
  - Thickening and decreased echogenicity of the dermis
  - Increased dermal vascularity (active phase)
- Nail (*See also* Chapter 8)
  - Thickening of the nail bed
  - Loss of definition of the ventral plate
  - Focal hyperechoic deposits in the ventral plate
  - Thickening and undulation of the dorsal and ventral plates
  - Increased vascularity in the nail bed (active phase)
- Tendon
  - Thickening and/or decreased echogenicity
- Joint
  - Synovial anechoic fluid of variable degrees upon activity which is more commonly seen (but not limited) in the wrist, hand [metacarpophalangeal joints], knee, and foot (metatarsophalangeal joints)
  - Synovial hypertrophy which is more frequently detected (but not limited) in the wrist and the knee)
  - Intra-articular and/or peri-articular increased vascularity upon activity
- Bone
  - Erosion of the bony margin
  - Proliferation of the bony margin

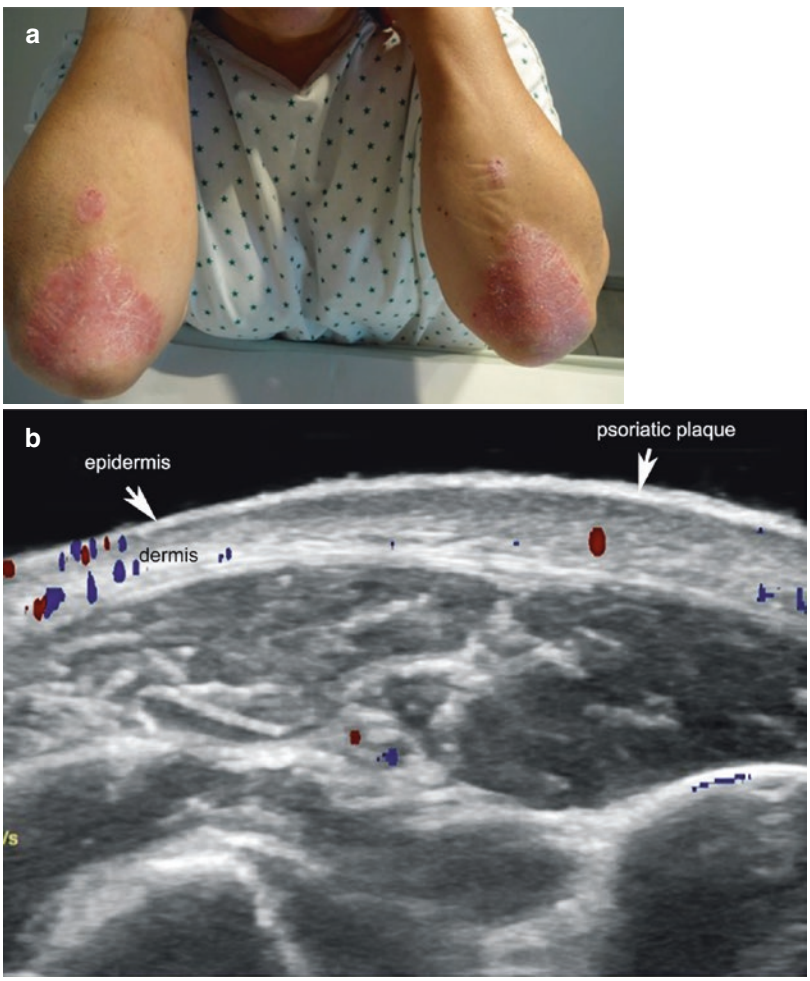


Fig. 9.22 Active psoriasis with skin, tendon, and bone involvement. (**a**) Clinical image. (**b**) Color Doppler ultrasound (transverse view, proximal part of the left forearm) shows epidermal and dermal thickening with dermal hypoechogenicity and hypervascularity. (**c**) Ultrasound (greyscale; longitudinal view; posterior aspect of the left elbow) demonstrates slightly decreased hypoechogenicity of the distal insertion of the triceps tendon and erosions (*arrowheads*) at the bony margin of the olecranon.

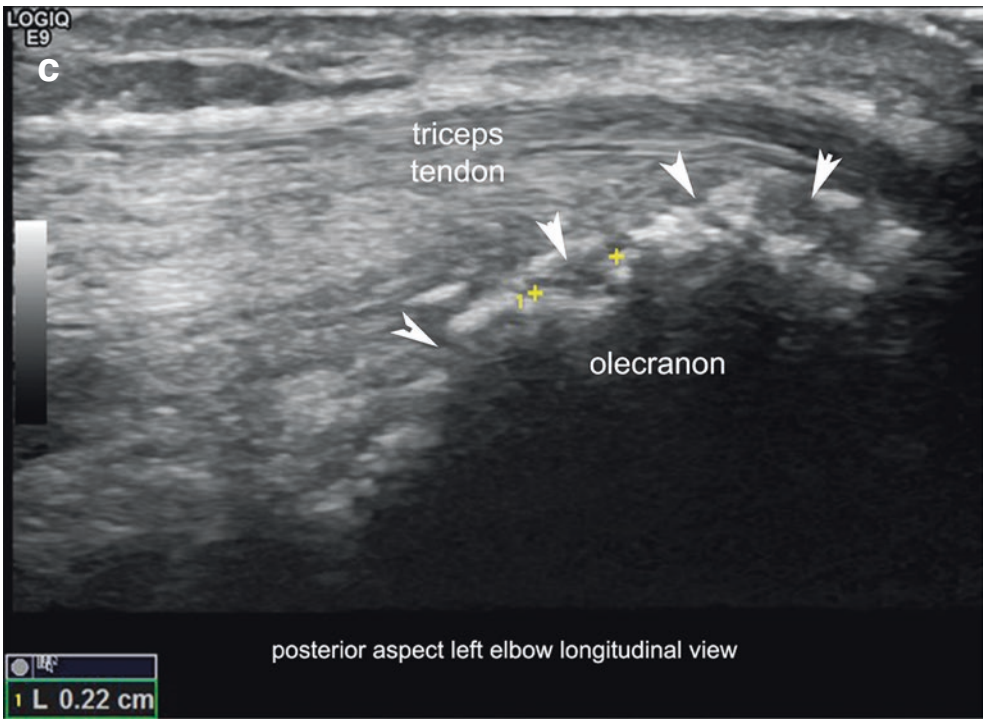


Fig. 9.22 (continued)

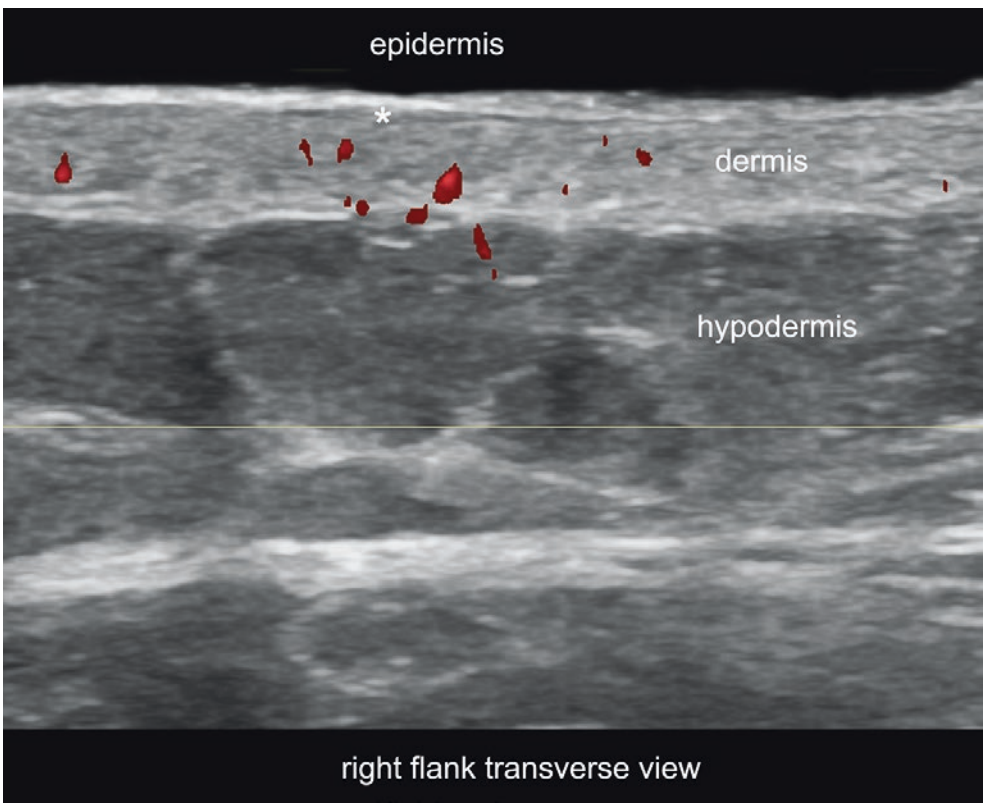


Fig. 9.23 Active psoriatic plaque. Color Doppler ultrasound (right flank; transverse view) demonstrates epidermal and dermal thickening with dermal hypoechogenicity (*asterisks*) and hypervascularity at the plaque.

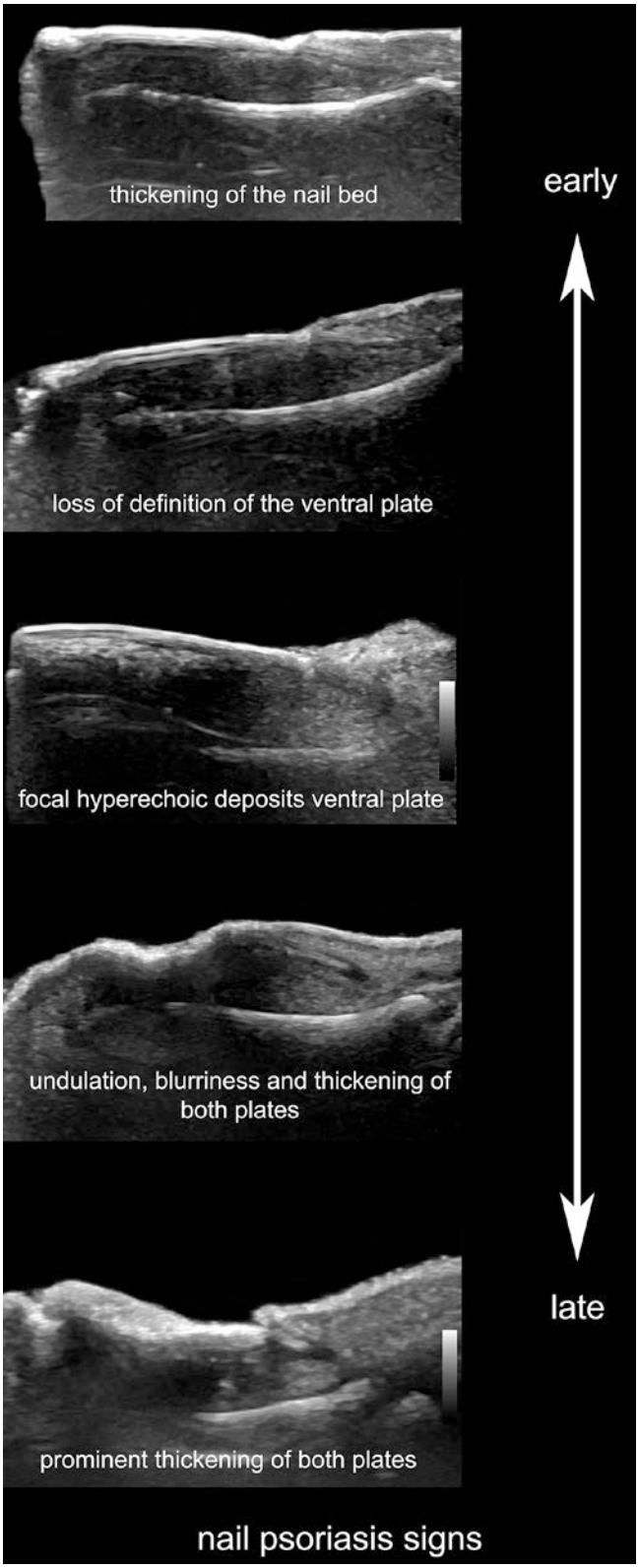


Fig. 9.24 Ultrasonographic signs of nail psoriasis.

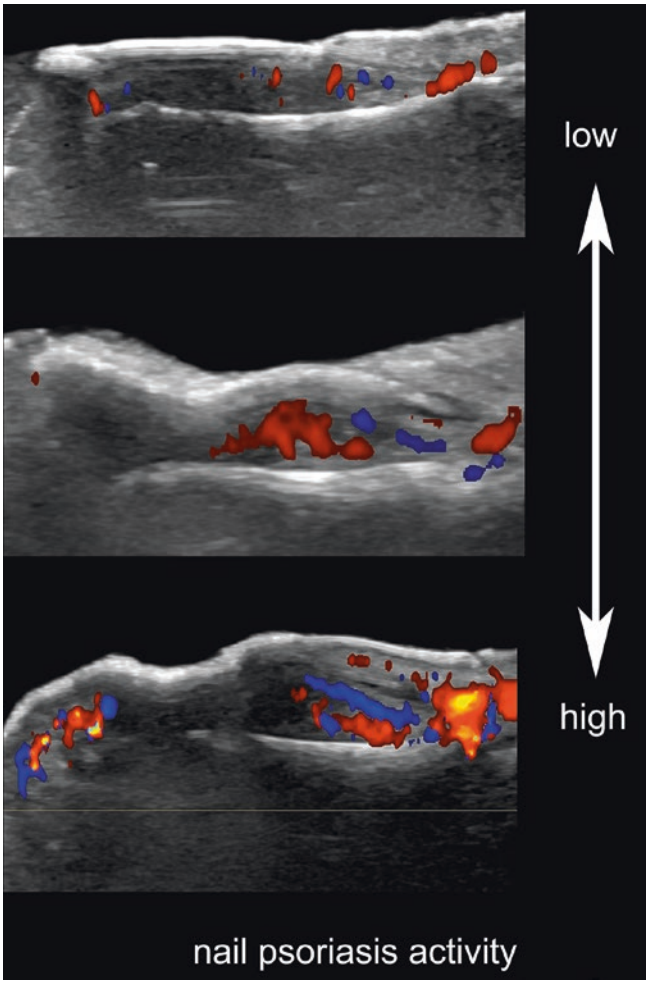


Fig. 9.25 Color Doppler ultrasound grading of activity in nail psoriasis.

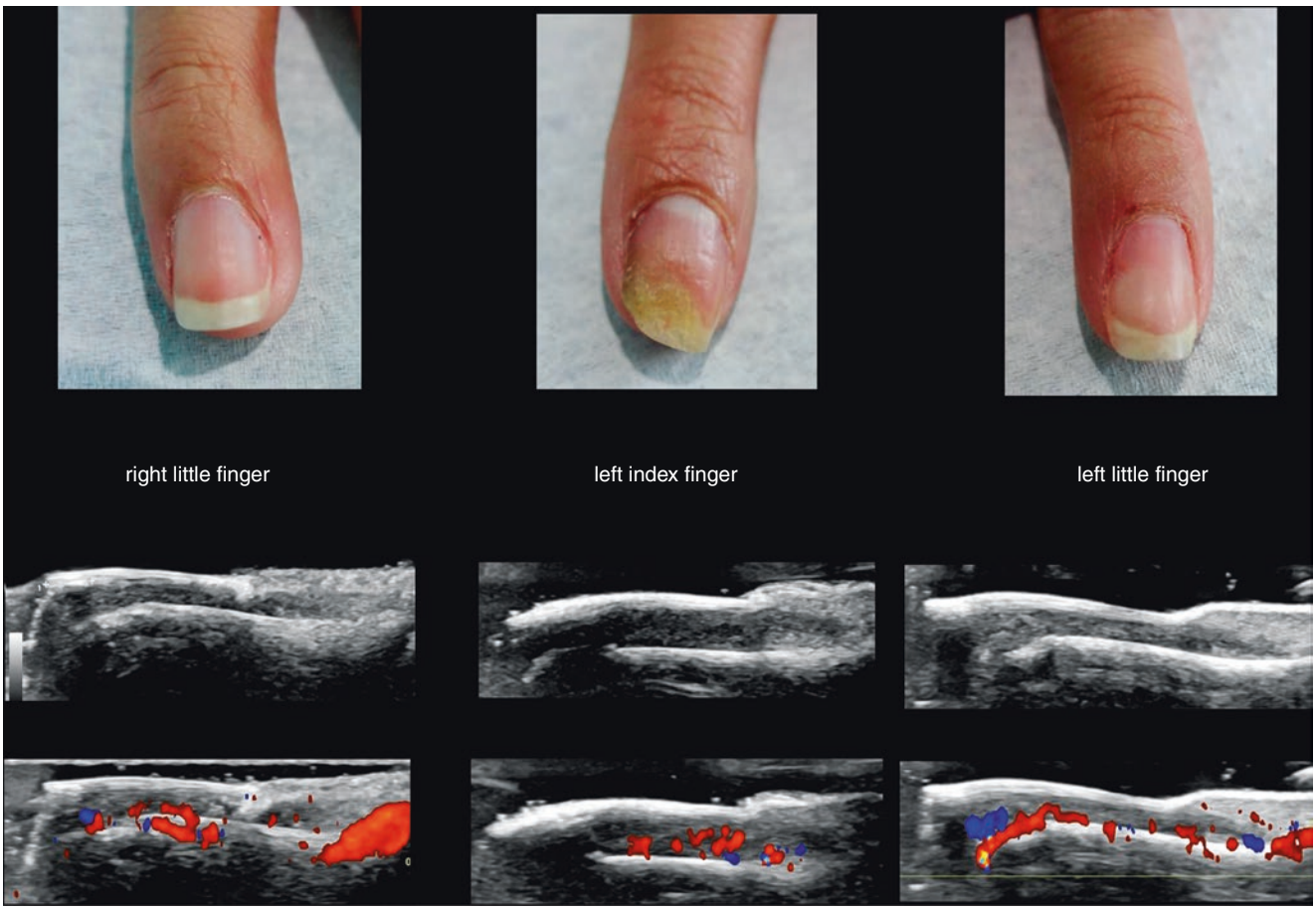


Fig. 9.26 Clinical and ultrasonographic correlation in active nail psoriasis. On top, the clinical images, and at the bottom, the greyscale and color Doppler ultrasound of the same fingers. Notice the presence of variable degrees of psoriasis severity in the different fingers.

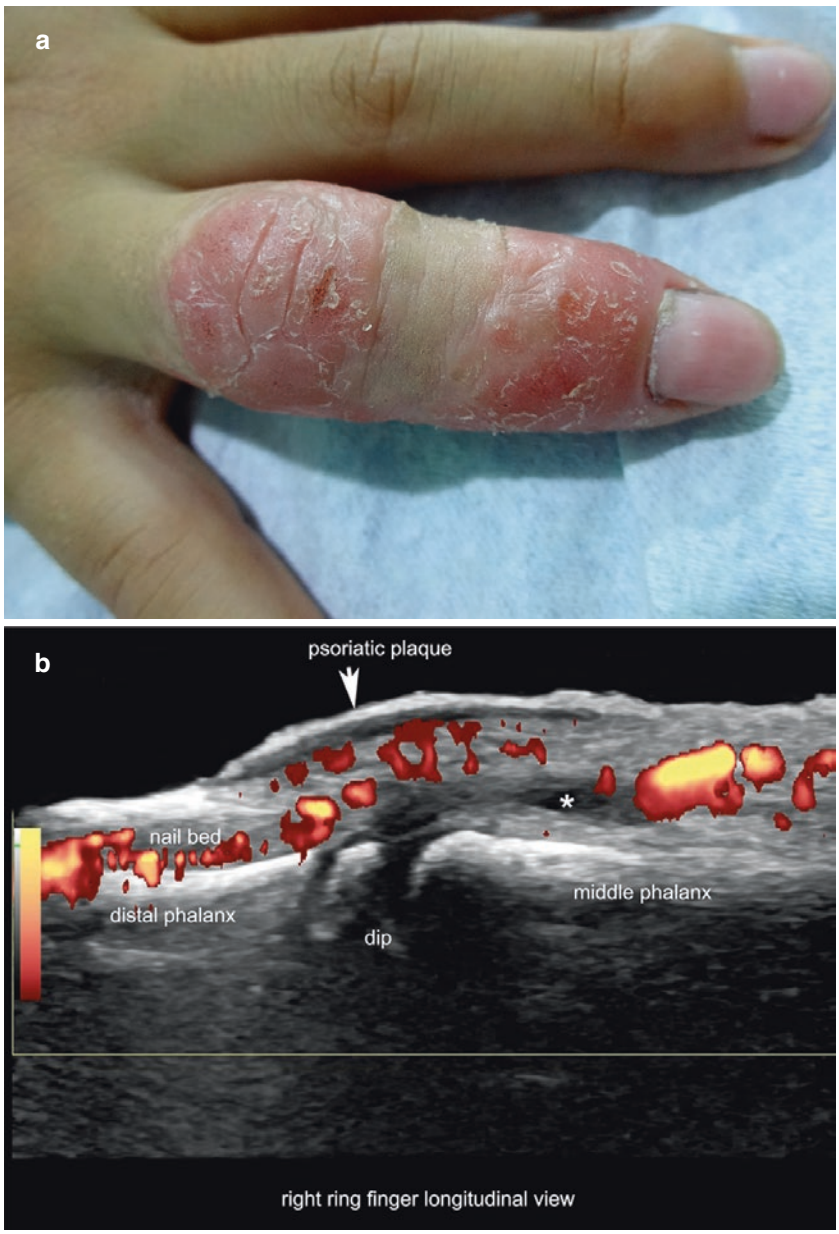


Fig. 9.27 Psoriasis with skin, tendon, joint and nail involvement. (**a**) Clinical photograph of a "sausage" ring finger in a 7-year-old child with cutaneous psoriasis. (**b**) Power Doppler ultrasound demonstrates thickening of the epidermis and dermis with decreased dermal echogenicity and dermal hypervascularity at the cutaneous plaque site in the periungual region. Notice the presence of anechoic fluid (*asterisk*) suggestive of synovitis in the distal interphalangeal joint (*dip*) with increased periarticular vascularity. There is also decreased echogenicity of the distal insertion of the lateral bands of the extensor tendon, as well as thickening of the nail bed and nail plate with increased vascularity in the nail bed.

9.8 Acne

9.8.1 Definition

Inflammatory cutaneous disease that affects the pilosebaceous unit with sebum, bacterial, and cornification unbalanced production. It is more common in adolescents and young adults [43, 44]. Acne can be scored on sonography by using a sonographic scoring called SOS-Acne that is shown in Table 9.3 [45].

9.8.2 Synonym

Acne vulgaris

Table 9.3 SOS-acne classification of severity

Severity	Number of lesions
Mild	<5 pseudocysts and without fistulae
Moderate	5–9 pseudocysts and without fistulae
Severe	≥10 pseudocysts and/or fistulae

Adapted from Wortsman et al. [45]

9.8.3 Key Sonographic Signs

- Dilatation of the hair follicles
- Thickening and decreased echogenicity of the dermis
- Dermal and/or hypodermal oval or round-shaped hypoechoic pseudocystic structures of variable size (Fig. 9.28; Video 9.2)
- Hypoechoic dermal and/or hypodermal band-like fistulous tracts
- Increased dermal vascularity upon activity
- Calcinosis: hyperechoic focal dermal spots that may or may not produce posterior acoustic shadowing (according to the size of the calcium deposits)
- Scarring: hypoechoic focal sites or hypoechoic bands with a fibrillar pattern in the dermis, which may cause varying degrees of epidermal retraction [46]

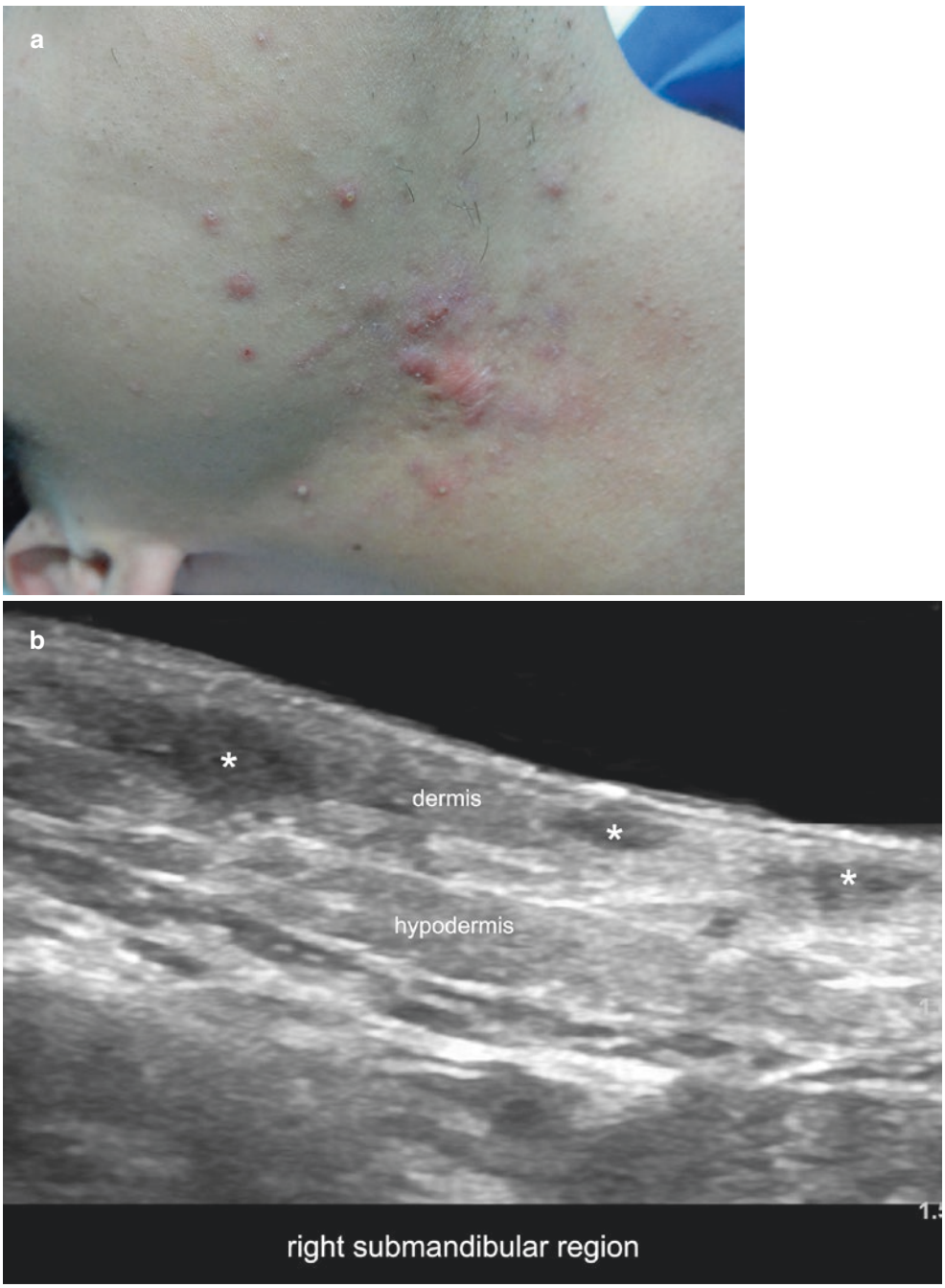


Fig. 9.28 Acne. (**a**) Clinical image. (**b**) Greyscale (longitudinal view; right mandibular region) shows three oval-shaped, hypoechoic structures (*asterisks*) suggestive of pseudocysts; the larger pseudocyst is located in the dermis and upper hypodermis; the two smaller pseudocysts present a dermal location. (**c**) Ultrasound (greyscale, longitudinal view; right mandibular region) shows a hypoechoic, band-like dermal structure (*asterisks*) compatible with a remnant fistula in the dermis and upper hypodermis. Notice the fibrillar pattern suggestive of prominent scarring in the periphery of the fistula. (**d**) Power Doppler ultrasound (transverse view; right mandibular region) demonstrates increased vascularity in the periphery of a dermal and upper hypodermal hypoechoic pseudocystic structure (*asterisks*). See Video 9.2.

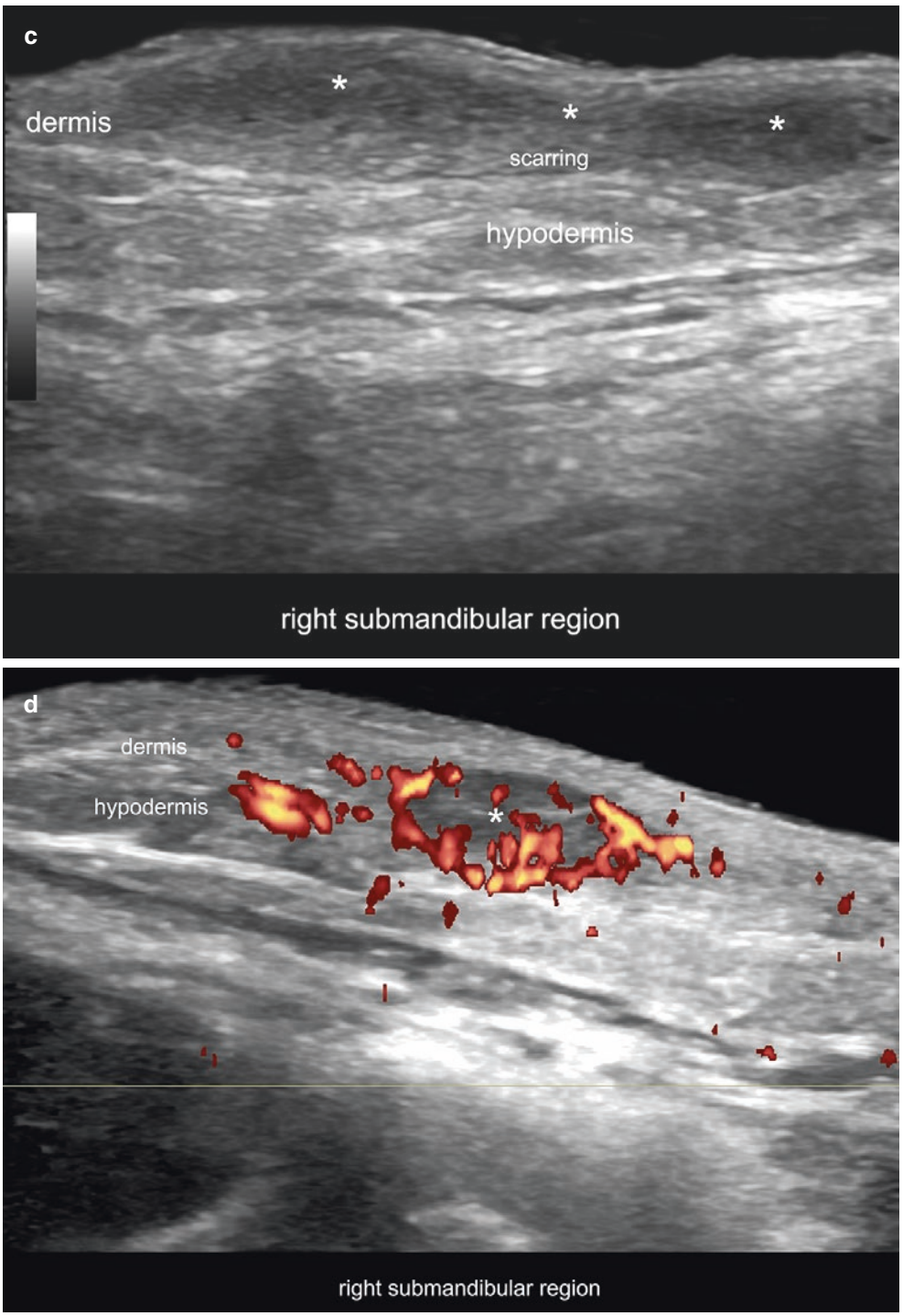


Fig. 9.28 (continued)

9.9 Hidradenitis Suppurativa

9.9.1 Definition

Chronic inflammatory disease that affects the terminal follicle and presents with recurrent nodules and abscesses, usually in the intertriginous region [47, 48]. The most common sites of clinical involvement of hidradenitis suppurativa (HS) are the axillary and perineal regions, but other regions that can be involved include the proximal and internal aspect of the arms, the posterior neck, the groin and pubic areas, the genitals (scrotum, labia majora), the proximal and internal aspect of the thighs, the mammary region, and gluteal region (intergluteal, infragluteal) [47–49].

9.9.2 Synonyms

Acne inversa, Verneuil's disease

9.9.3 Classification and Staging

The most commonly used clinical scoring of HS severity is Hurley's classification [50]. This staging system is as follows:

- Stage I: Solitary or multiple abscesses without fistulous tracts or scarring
- Stage II: Recurrence of single or multiple abscesses, with fistulous tract and scarring in widely separated lessions
- Stage III: Multiple abscesses interconnected with fistulous tracts running across an area entirely affected.

Ultrasound has proved useful for characterizing the subclinical anatomical abnormalities [51–59], providing sonographic diagnostic criteria and the possibility of staging the disease through the sonographic scoring called SOS-HS [57] (Table 9.4). This can be done through an assessment of the real extent, severity, and activity of the disease in adults and children (usually pre-adolescent) [57–65]. Frequently, there are subclinical sonographic alterations that can easily be missed by the clinical examination, including fluid collections and fistulous tracts that can influence the degree of severity of the disease [1, 55–65]. In addition, retained fragments of hair tracts within the lesions may contribute to the generation and perpetuation of the inflammatory process [59]. Fistulous tracts can be classified according to the degree of fibrosis and edema [62] (Tables 9.5 and 9.6). Therefore, color Doppler ultrasound examinations are strongly recommended to support the diagnosis, staging, and monitoring of HS.

Table 9.4 Sonographic Scoring of Hidradenitis Suppurativa (SOS-HS)

Stage	Sonographic signs
Stage I	Single fluid collection and/or dermal changes affecting a single body segment (either one side or bilateral), without fistulous tracts
Stage II	Two to four fluid collections and/or a single fistulous tract with dermal changes, affecting up to two body segments (either one side or bilateral)
Stage III	Five or more fluid collections and/or two or more fistulous tracts with dermal changes, and/or involvement of three or more body segments (either one side or bilateral)

Adapted from Wortsman et al. [57]; with permission of Dermatologic Surgery

Table 9.5 Grading of fibrosis and edema of fistulous tracts in hidradenitis suppurativa

Grade	Sonographic signs
Grading of fibrosis	
0	Absent
1	Thin peripheral hypoechoic band (intermittent or continuous) with a fibrillar pattern
2	Thick and continuous peripheral hypoechoic band with a fibrillar pattern that invades the lumen of the tract and produces a hypoechoic "halo" sign in transverse view (intermittent or continuous)
Grading of edema	
0	Absent
1	Diffuse increase of the echogenicity of the hypodermis
2	Prominent hyperechoic hypodermal fatty lobules, with anechoic fluid between the fatty lobules

Adapted from Wortsman et al. [62]; with permission from Elsevier

Table 9.6 Types of fistulous tracts in hidradenitis suppurativa

Grade	Types of fistulous tracts according to grading of fibrosis and edema
1	Low fibrotic scarring (grades 0–1) with high or low edema (grades 0–2)
2	High fibrotic scarring (grade 2) with low edema (grades 0–1)
3	High fibrotic scarring (grade 2) with high edema (grade 2)

Adapted from Wortsman et al. [62]; with permission from Elsevier

9.9.4 Key Sonographic Signs and Sonographic Diagnostic Criteria

The key sonographic signs of HS are (Figs. 9.29, 9.30, 9.31, 9.32, 9.33, 9.34, and 9.35; Video 9.3):

- Widening of the hair follicles
- Thickening and/or abnormal echogenicity of the dermis
- Dermal pseudocystic nodules (i.e., round or oval-shaped hypoechoic or anechoic nodular structures)
- Fluid collections (i.e., anechoic or hypoechoic sac-like fluid deposits in the dermis and/or hypodermis connected to the base of widened hair follicles)
- Fistulous tracts (i.e., anechoic or hypoechoic band-like structures across skin layers in the dermis and/or hypodermis connected to the base of widened hair follicles)
- On color Doppler, increased vascularity in the periphery of the key lesions (pseudocysts, fluid collections, and fistulous tracts) is commonly detected and can show peripheral, inner, or mixed patterns. The presence of inner vascularity is commonly due to prominent fibrinous and inflammatory tissue within the lesions. The hypervascularity is "per se" a sign of inflammation; therefore, it means that the disease is active).

The sonographic diagnostic criteria of hidradenitis suppurativa are the presence of three or more of the first five key sonographic signs listed above [57].

Since ultrasound detects subclinical abnormalities in HS (Fig. 9.36), it is not uncommon to find discordance between the clinical and sonographic scorings (Fig. 9.37) [57, 60].

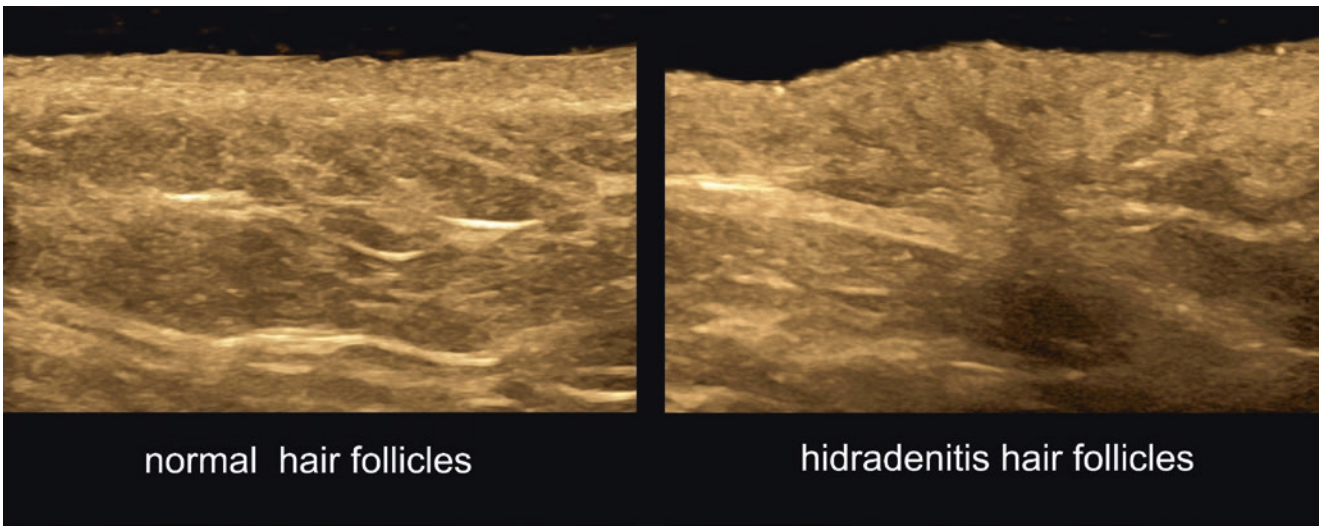


Fig. 9.29 Hidradenitis suppurativa (HS). Widening of the hair follicles. Ultrasound (greyscale; axillary regions) comparative views of normal versus HS hair follicles.

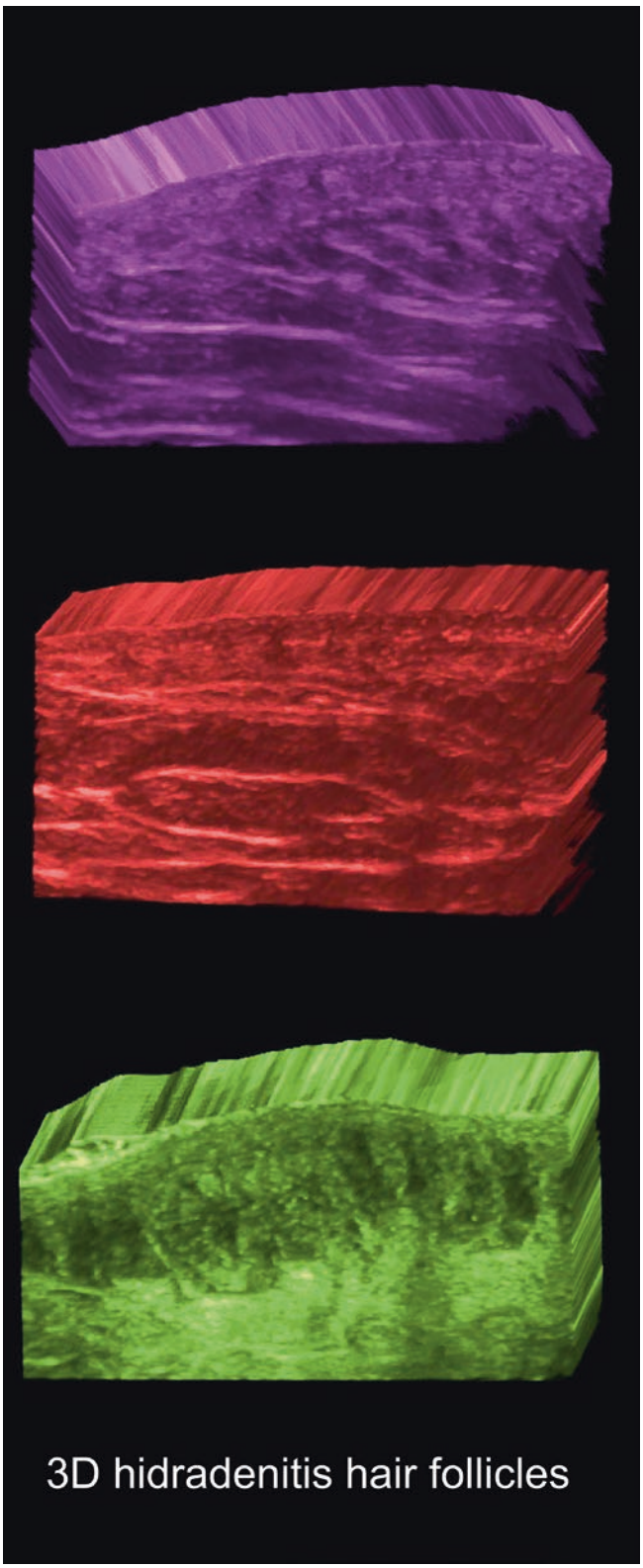


Fig. 9.30 3D ultrasound grading of the widening of the hair follicles in HS. On top, low widening; at the bottom, high widening. Notice that the base of the hair follicles is wider than the most superficial part, which has been named the "champagne bottle" sign.

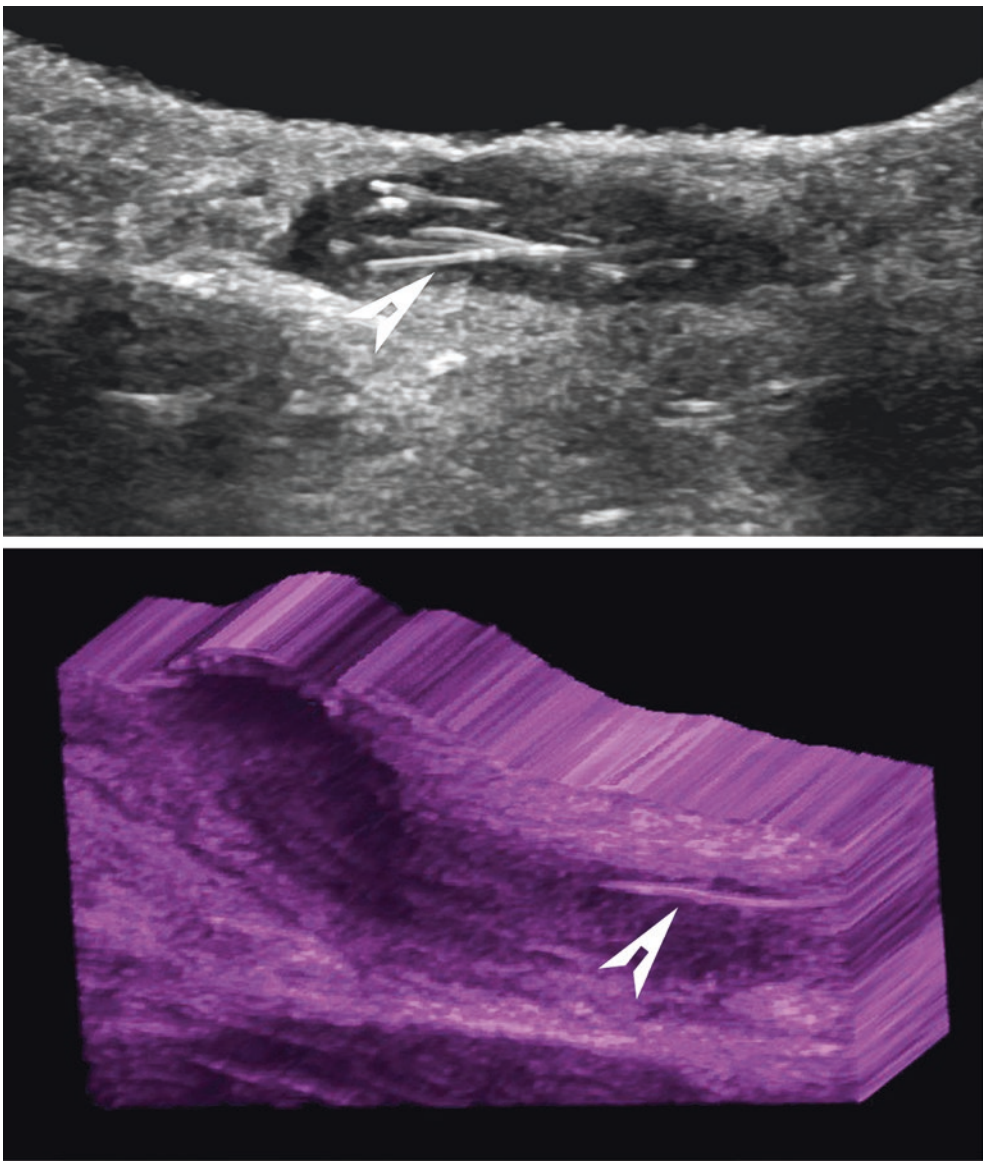


Fig. 9.31 Retained fragments of hairs in HS lesions. Notice the hyperechoic linear structures suggestive of fragments of hair tracts (*arrowheads*) within a pseudocyst (top) and a fistulous tract (bottom).

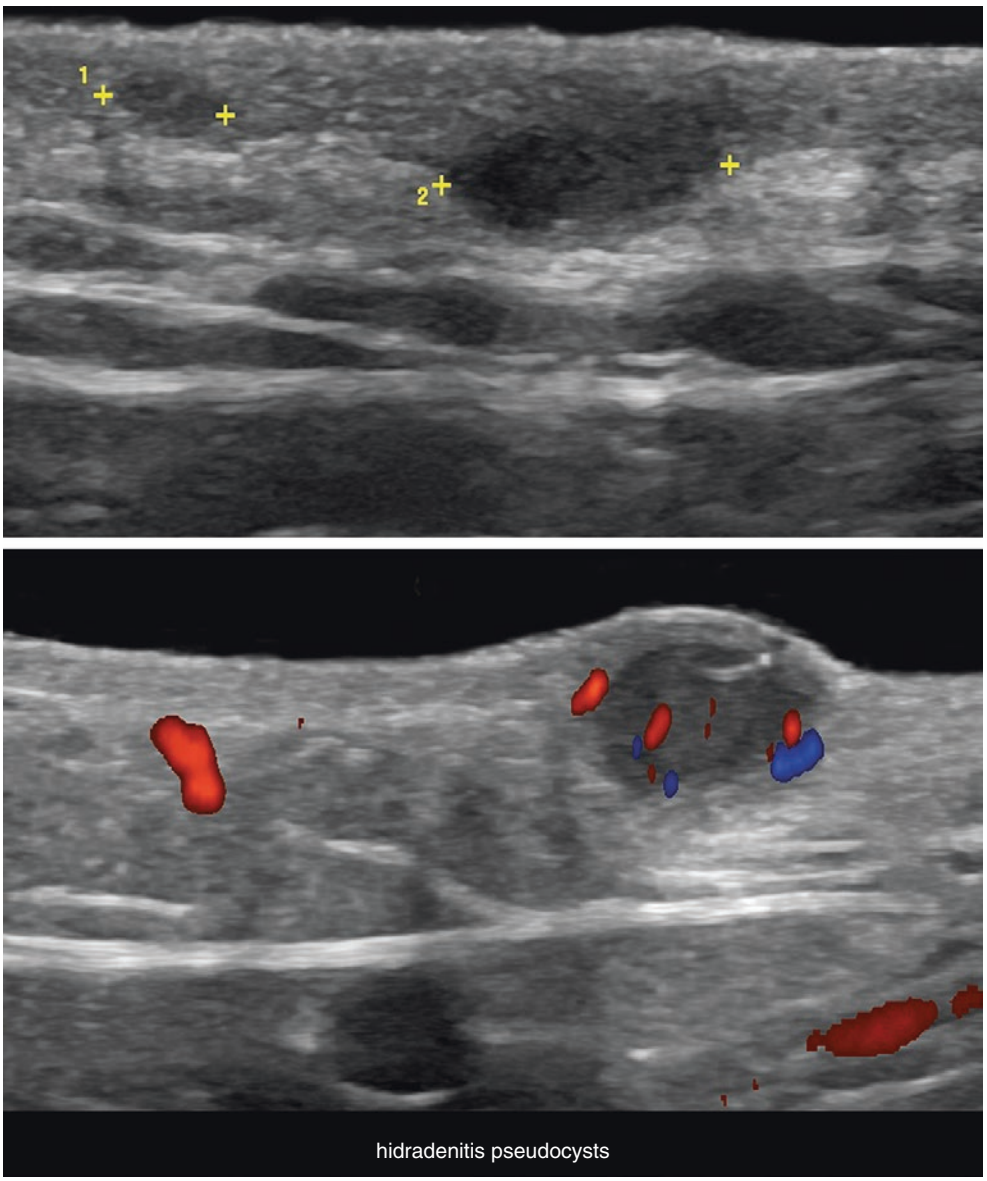


Fig. 9.32 Pseudocysts in HS. Notice the oval-shaped, hypoechoic dermal and upper hypodermal structures (between markers, top) that correspond to pseudocysts.

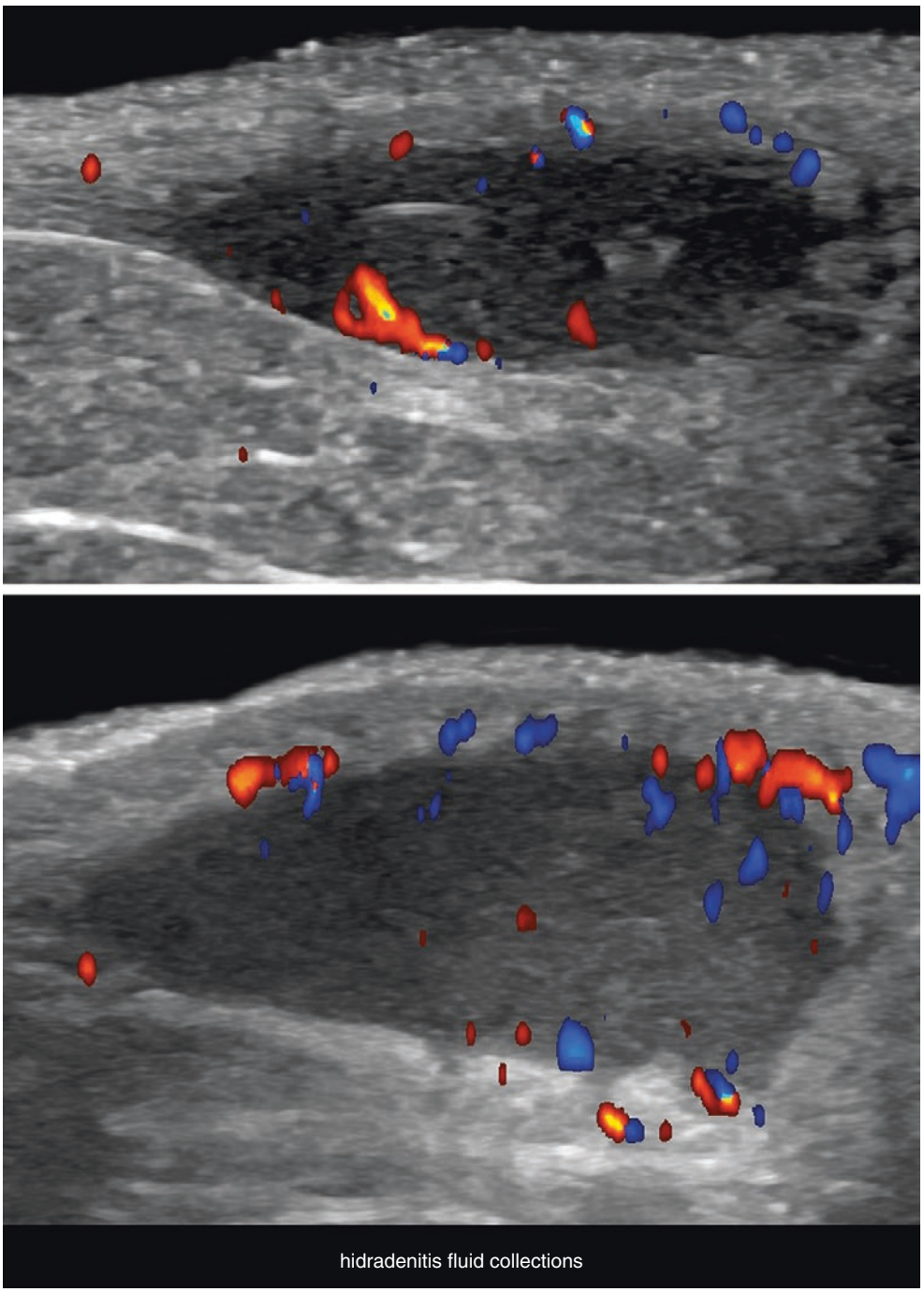


Fig. 9.33 Fluid collections in HS. Dermal and hypodermal hypoechoic sac-like structures. Notice the presence of fragments of hair tracts (top) and the predominant peripheral hypervascularity of the collections.

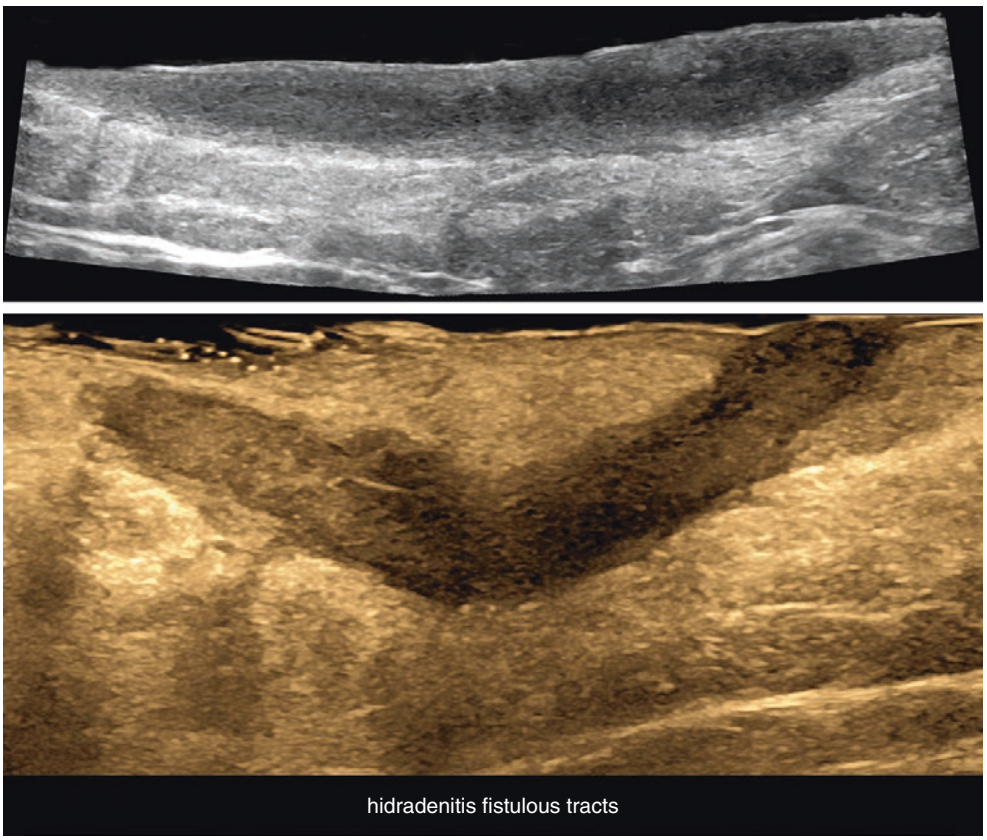


Fig. 9.34 Fistulous tracts in HS. Hypoechoic band-like dermal and hypodermal structures.

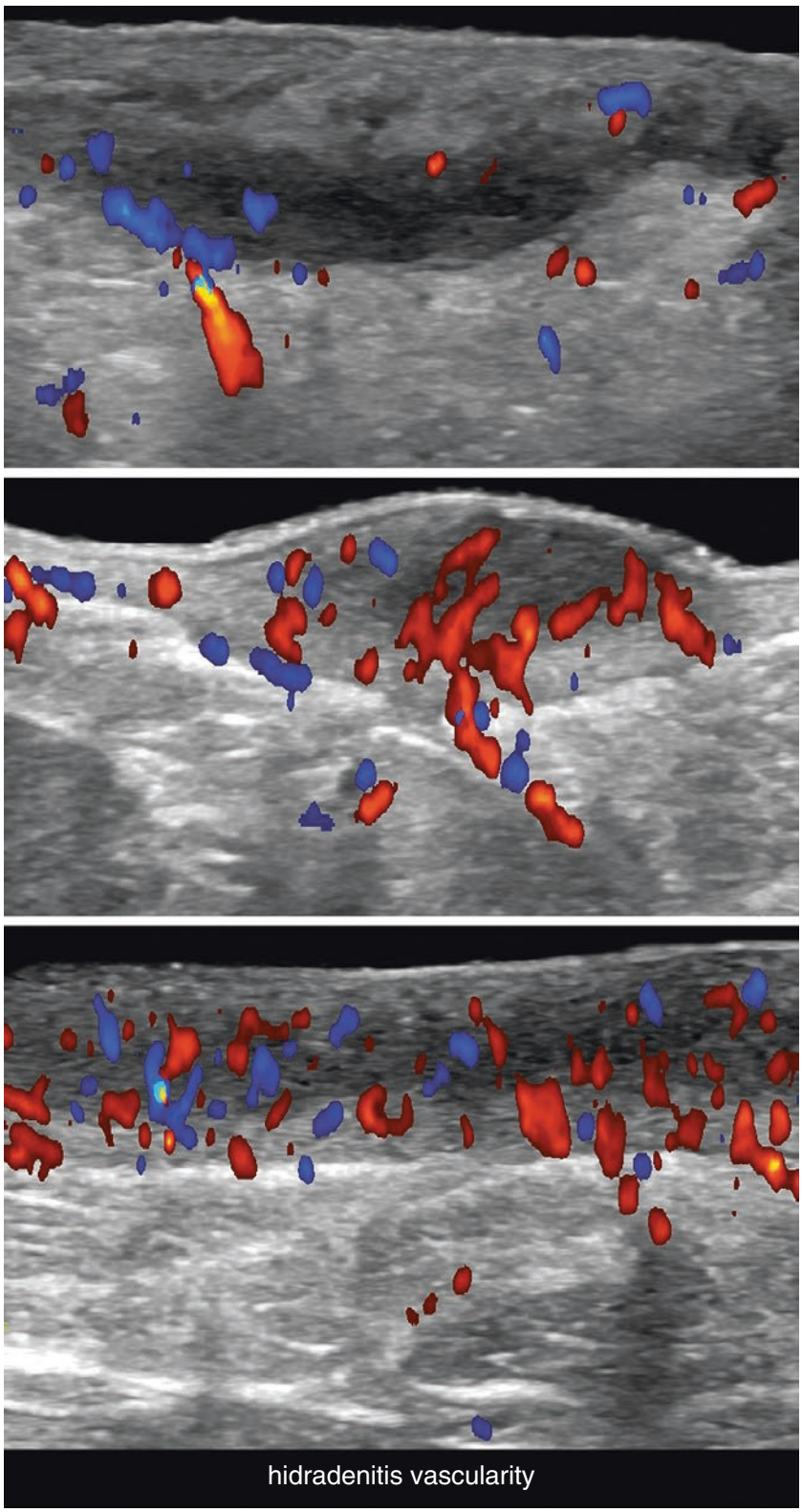


Fig. 9.35 Grading vascularity of HS lesions from low (top) to high (bottom). Notice how the peripheral and inner patterns of blood flow vary according to the different levels of inflammation (activity).

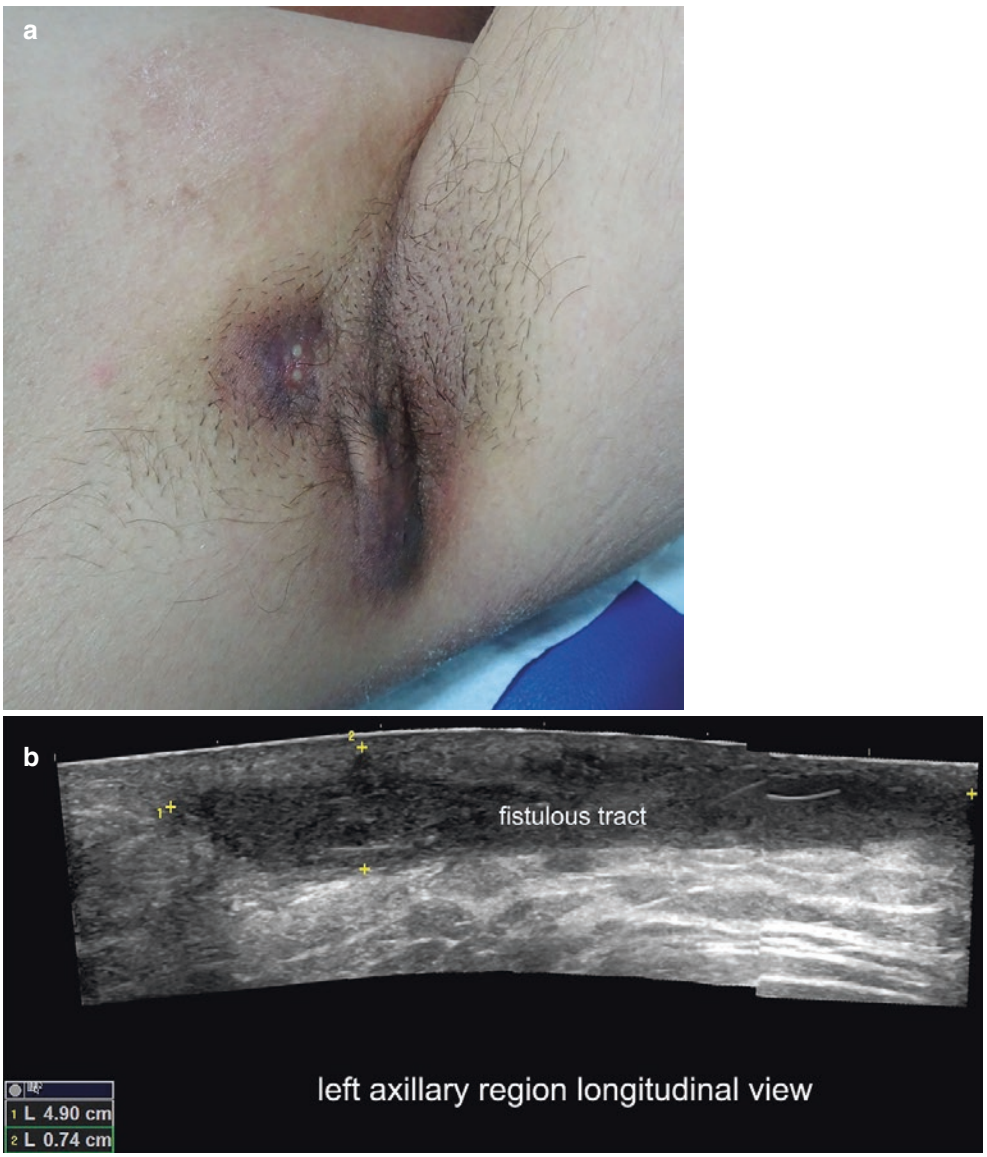
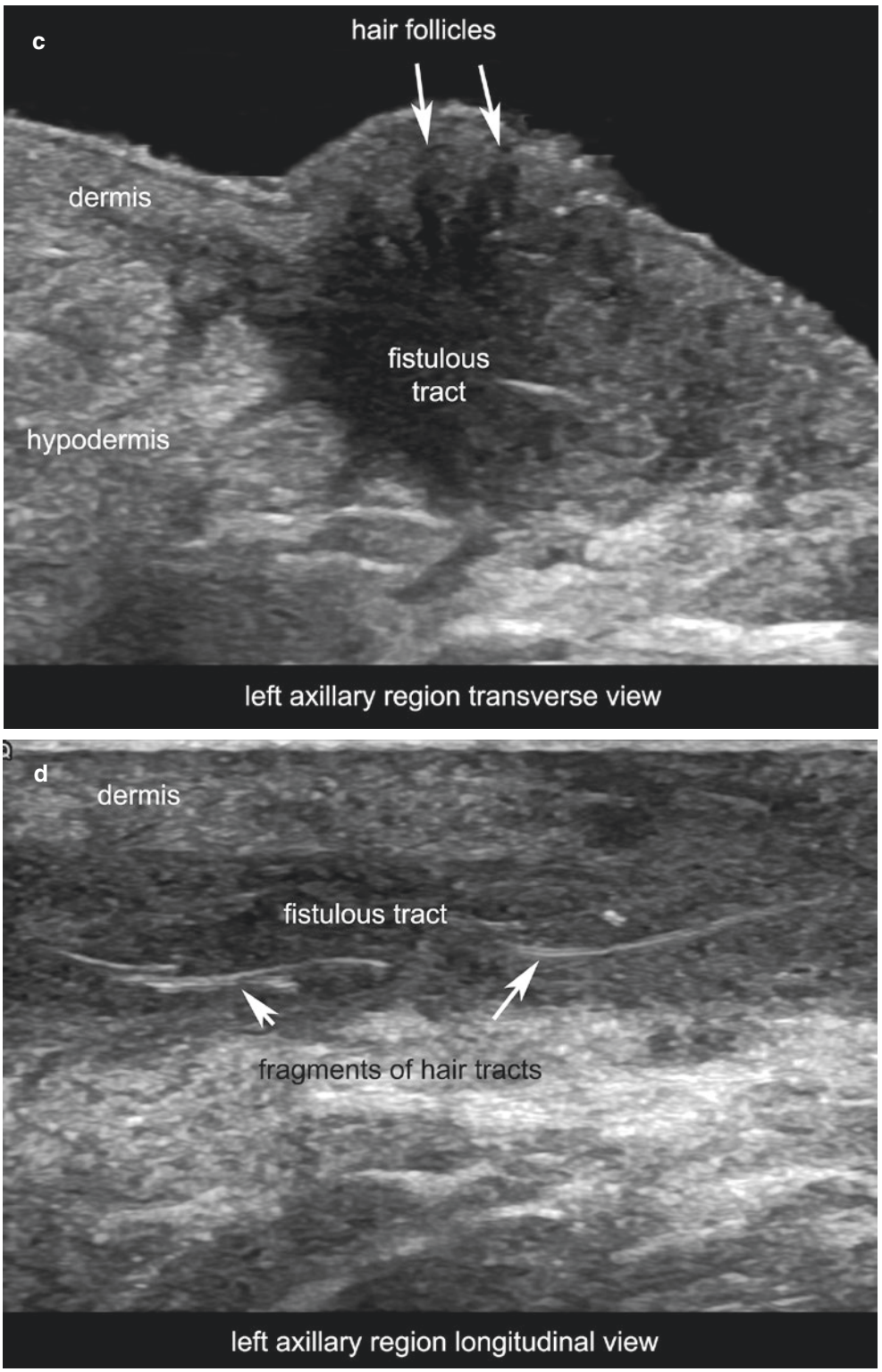


Fig. 9.36 Hidradenitis suppurativa (HS) clinical and sonographic correlation. (**a**) Clinical photograph of a patient clinically staged Hurley II. (**b**–**e**) Ultrasound and color Doppler ultrasound of the same patient sonographically staged as SOS-HS II. (**b**) Ultrasound (greyscale, longitudinal view; left axillary region) demonstrates a 4.9-cm (long) × 0.74-cm (thickness) dermal and hypodermal hypoechoic band-like structure compatible with a type 1 fistulous tract. (**c**) Ultrasound (greyscale; transverse view) shows the connections between the fistulous tract and the base of widened hair follicles, as well as the thickening and decreased echogenicity of the regional dermis. (**d**) Ultrasound (greyscale; longitudinal view) shows hyperechoic linear structures within the fistulous tracts compatible with fragments of hair tracts. (**e**) On color Doppler ultrasound (longitudinal view), there is increased vascularity in the periphery of the fistulous tract.



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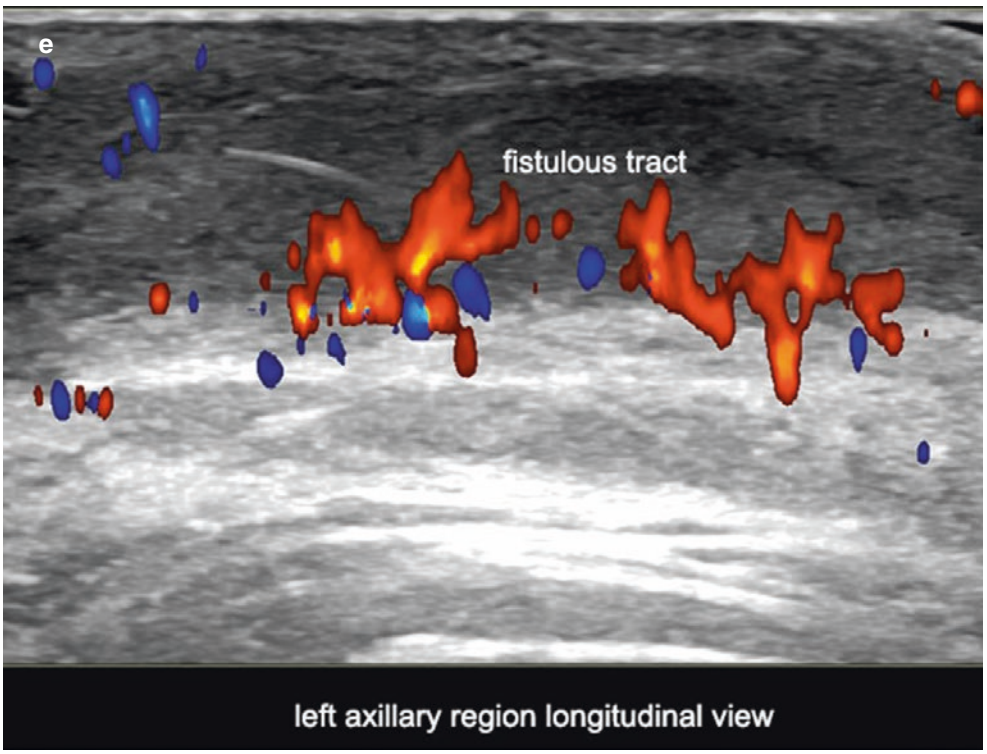

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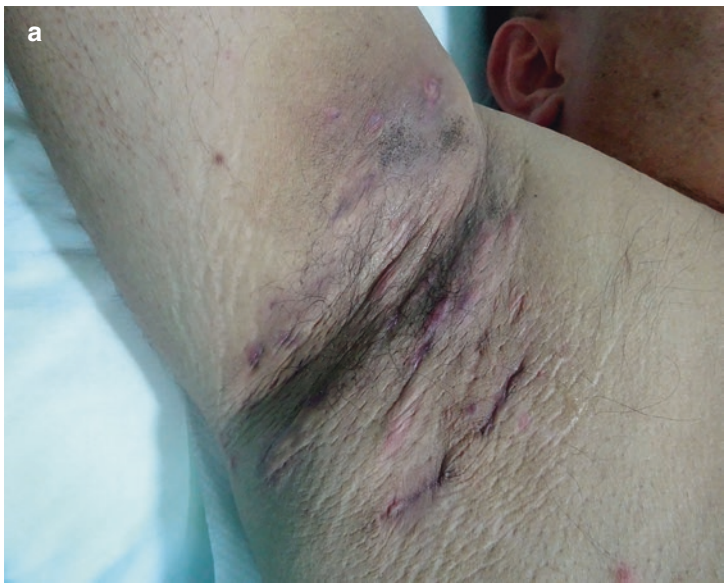


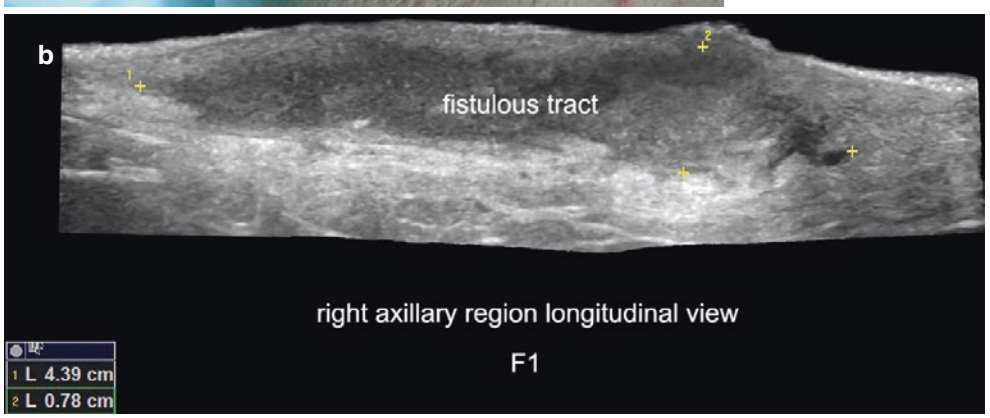


Fig. 9.37 HS clinical and sonographic correlation discordance. (**a**) Clinical photograph of a patient clinically staged Hurley II. (**b** and **c)** show sonographic findings that suggestive of SOS-HS III. Greyscale ultrasound (**b**, right axillary region, longitudinal view) shows one of the three communicating type 2 fistulous tracts running in the right axillary region (4.39 cm long × 0.78 cm thickness). **(c)** (left axillary region, longitudinal) demonstrates one of the ten type 2 fistulous tracts running in the left axillary region (2.52 cm long × 0.47 cm thickness). Eight of these were communicating tracts that affected the axillary region and the proximal part and inner aspect of the left arm. See Video 9.3.

Fig. 9.37 (continued)

9.10 Odontogenic Fistula

9.10.1 Definition

Abnormal communicating fistulous tract or sinus between the periodontal region and the skin, originating in a dental infection. Approximately 70% of these are located in the mandibular region and 30% in the maxillary region. Clinical difficulties in the differential diagnosis may involve other inflammatory cutaneous lesions such as acne or folliculitis barbae, as well as some benign and malignant cutaneous tumors [1, 66].

9.10.2 Key Sonographic Signs

The most commonly found sonographic signs are [1, 28, 66, 67] (Fig. 9.38):

- Hypoechoic band-like structure running through the subepidermal, dermal, hypodermal, muscular, and periosteal layers, connecting with the bony margin of the mandible or the maxillary bone.
- Variable degrees of epidermal retraction or bulging, disruption, and/or irregularities.
- An erosion of the bony margin at the site of connection is filled with hypoechoic granulation and inflammatory tissue.
- A thin hypoechoic band is usually adjacent to the bony margin and follows to the periodontal region.
- On color Doppler, there is increased vascularity in the periphery of the fistulous tract.

Fig. 9.38 Odontogenic fistula. (**a**) Clinical image. (**b** and **c**) Ultrasound of the chin region. (**b**) Greyscale (longitudinal view) and (**c**) color Doppler (transverse view) demonstrate 1.67-cm long × 0.42-cm thick, hypoechoic band-like structure (between markers) suggestive of a fistulous tract connecting the subepidermal region with the anterior and central aspect of the mandible bony margin. Notice the erosion of the bony margin at the site of connection with the bone. Increased hypodermal echogenicity and slight hypervascularity were detected in the periphery of the tract.

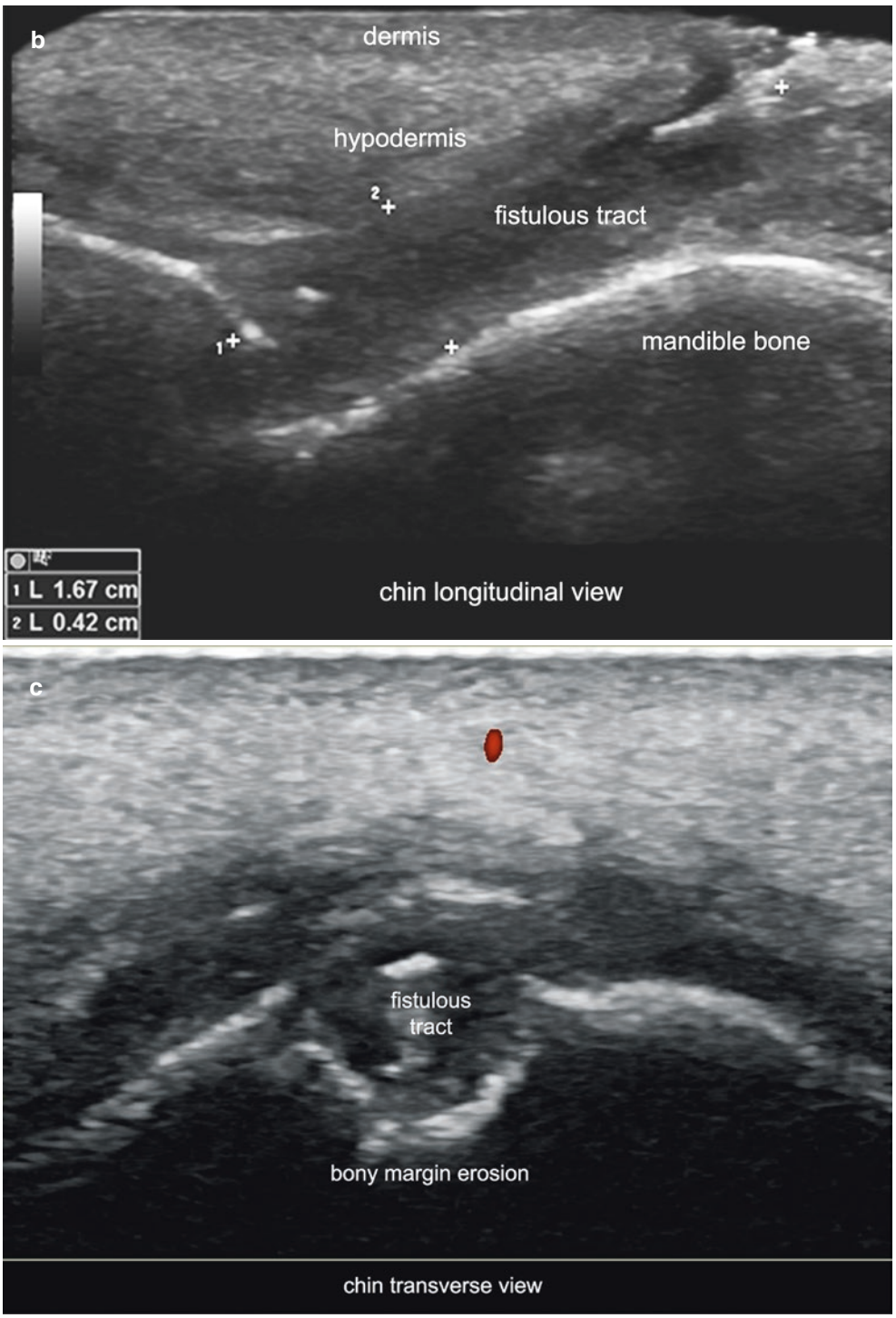


Fig. 9.38 (continued)

9.11 Foreign Bodies

9.11.1 Definition

Exogenous materials that enter into the human body. Usually, they are accidentally located in the cutaneous layers and may simulate other types of cutaneous conditions. They can be divided according to their origin into organic (derived from living structures, such as splinters of wood or thorns of roses) and synthetic or inert (such as fragments of metal or glass). Ultrasound can support the detection, identification, exact location, measurement, assessment of the axis, and removal of the foreign bodies, guiding their percutaneous extraction [1, 68–72].

9.11.2 Key Sonographic Signs

Common sonographic signs of foreign bodies are (Figs. 9.39, 9.40, 9.41, 9.42, and 9.43):

- Hyperechoic linear or bilaminar structure(s) usually surrounded by hypoechoic inflammatory and/or granulomatous tissue
- Occasionally, very small organic foreign bodies may appear as tiny hyperechoic spots surrounded by hypoechoic tissue.
- Inert or synthetic materials commonly show posterior reverberance artifact
- Anechoic or hypoechoic fluid collections may be found in the periphery of the foreign body owing to the generation of hematoma or serohematoma.
- Sometimes, hyperechoic spots with posterior reverberance artifact are detected in the periphery, owing to air bubbles

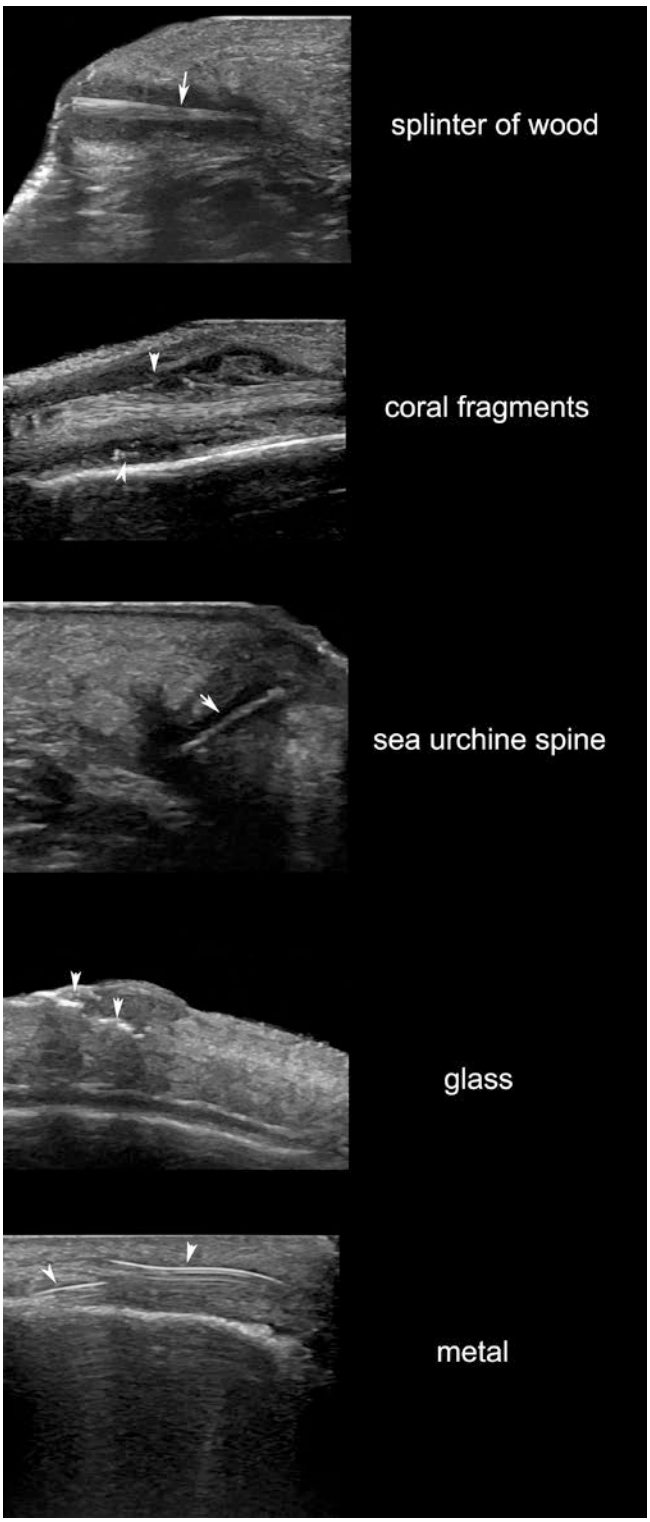


Fig. 9.39 Sonographic appearance of common types of foreign bodies.

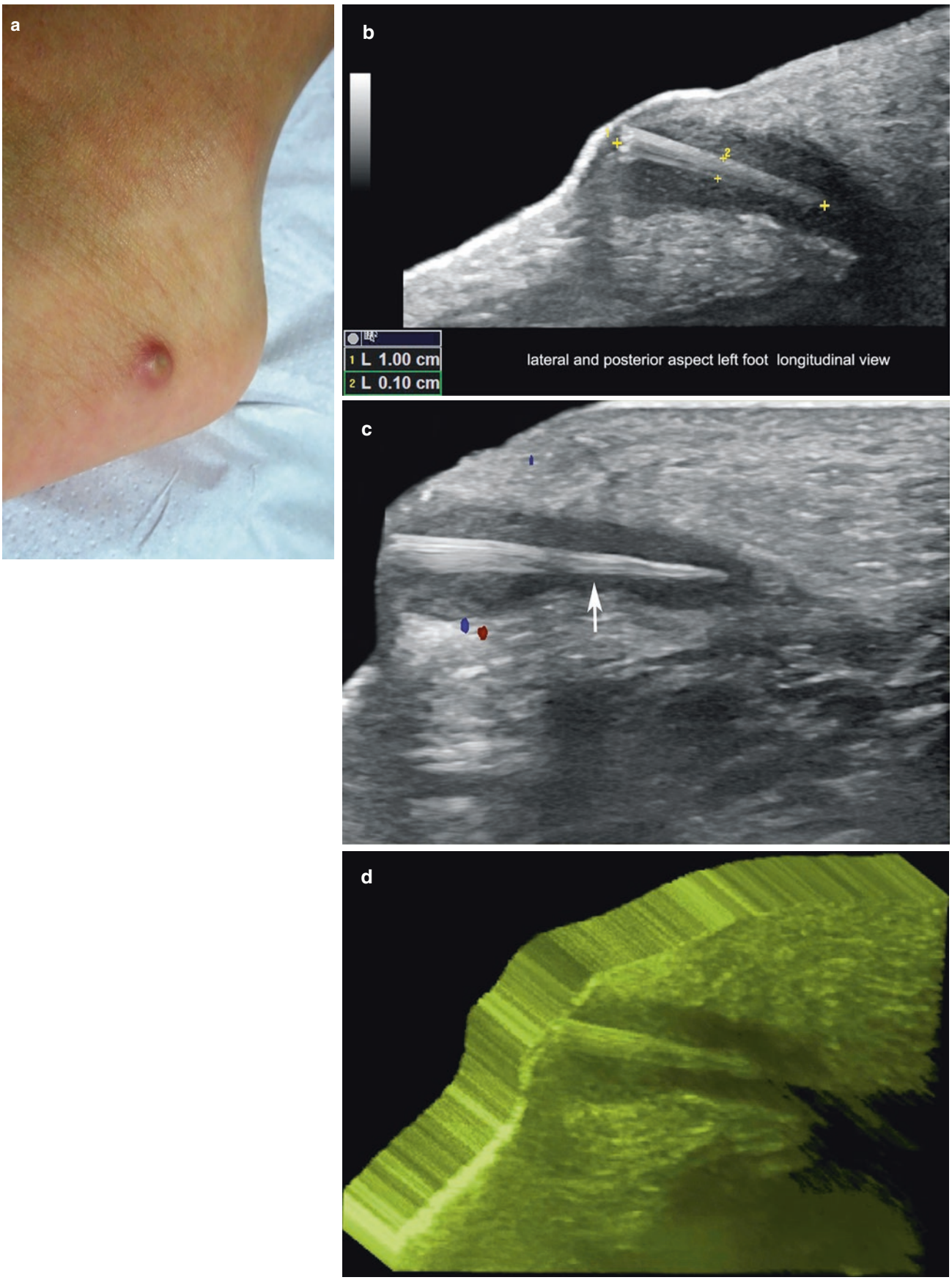


Fig. 9.40 Splinter of wood. (**a**) Clinical image of the lesion. (**b**–**d**) Ultrasound (**b**, greyscale; **c**, color Doppler; **d**, 3D reconstruction; longitudinal and posterior aspect of the left foot) demonstrates 1.0 cm long × 0.1 cm thick, dermal and hypodermal hyperechoic linear structure (between markers in **b**) surrounded by hypoechoic tissue (*arrow* in **c**). There is a slight increase of vascularity in the periphery of the lesion.

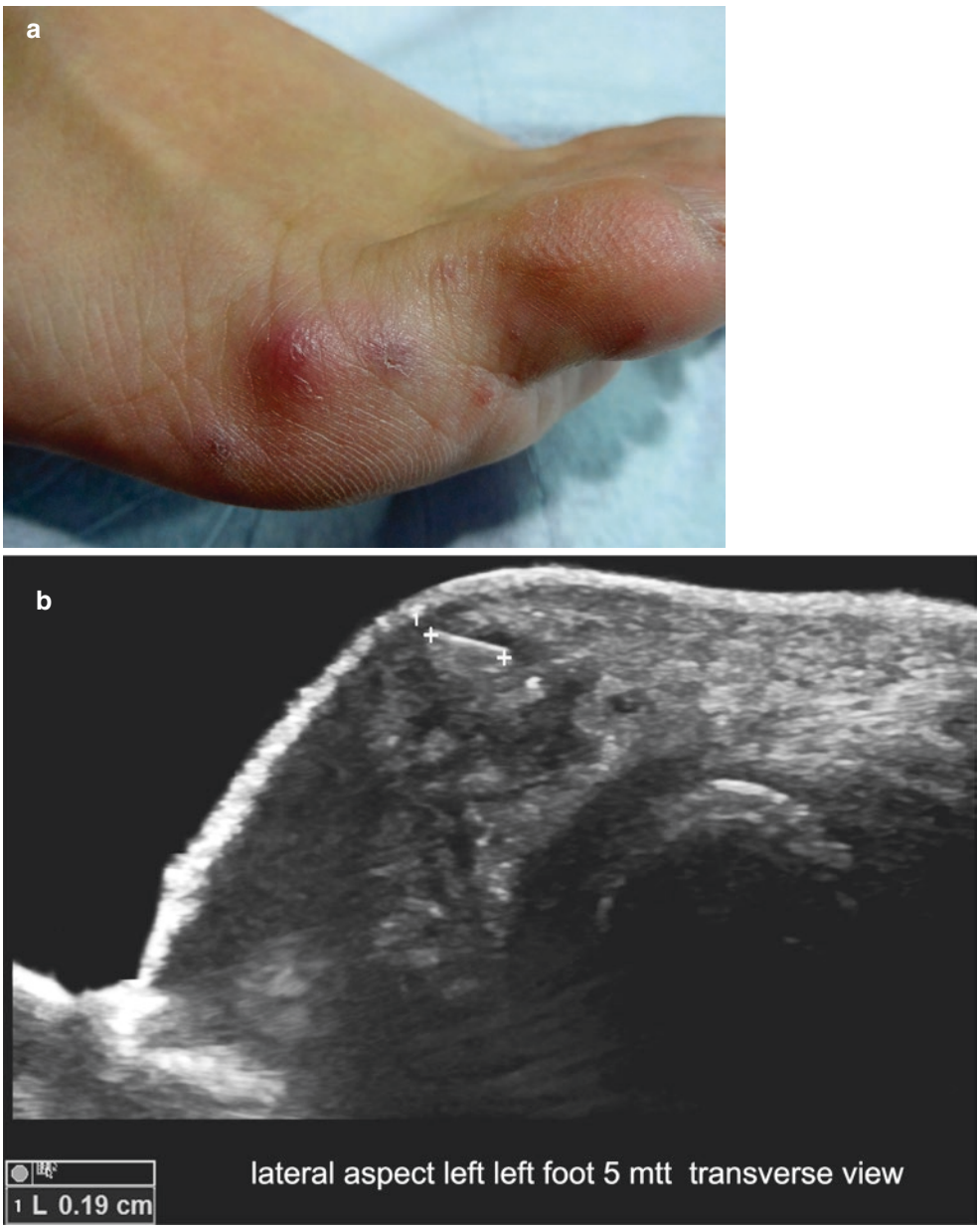


Fig. 9.41 Coral fragments. (**a**) Clinical photograph. (**b**, **c**) Ultrasound (**b**, greyscale; **c**, color Doppler; transverse views; lateral aspect of the left foot) demonstrates small linear and bilaminar hyperechoic dermal and hypodermal fragments of coral surrounded by hypoechoic and heterogeneous tissue. Color Doppler (**c**) shows increased vascularity surrounding the fragments.

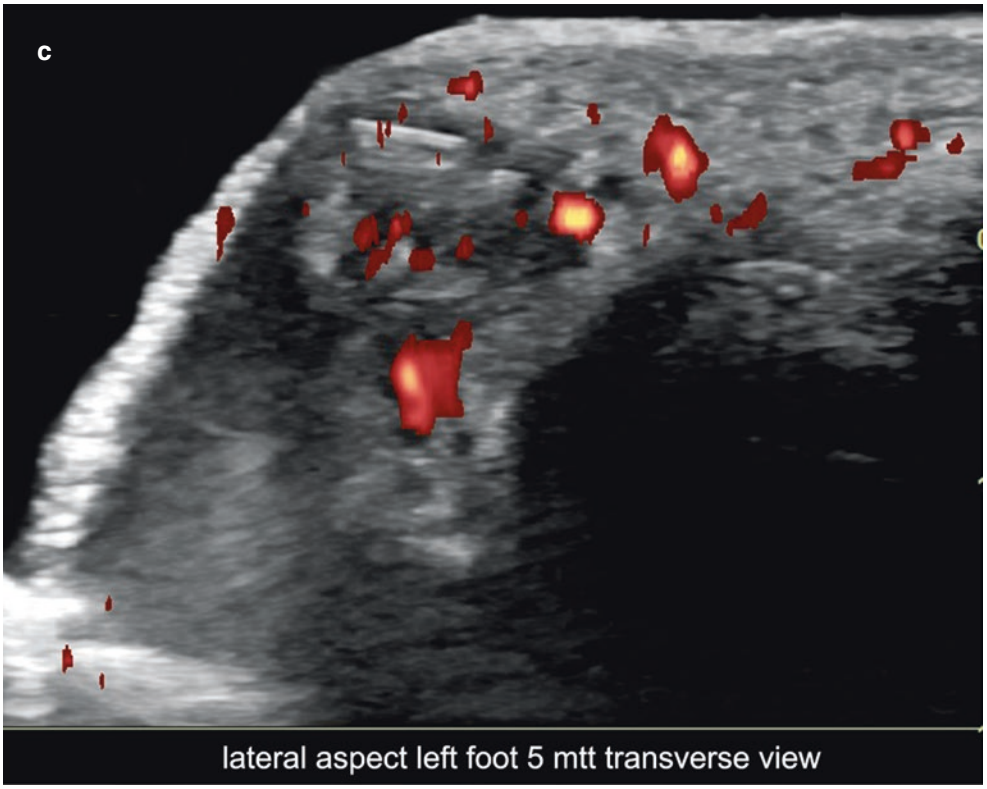
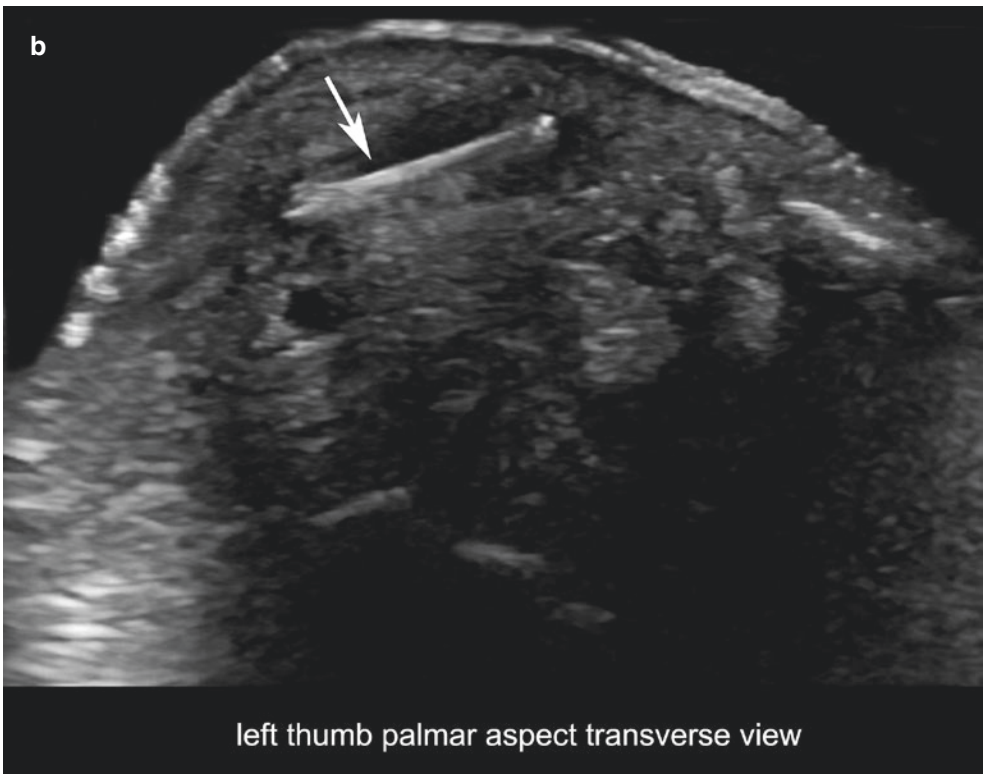


Fig. 9.41 (continued)

Fig. 9.42 Fragment of glass. (**a**) Clinical image. (**b**) Greyscale, and (**c**) color Doppler ultrasound (transverse views; palmar aspect; transverse views) show a hyperechoic bilaminar hypodermal structure with posterior reverberance artifact. On color Doppler (**c**), increased blood flow in the periphery of the structure is observed.



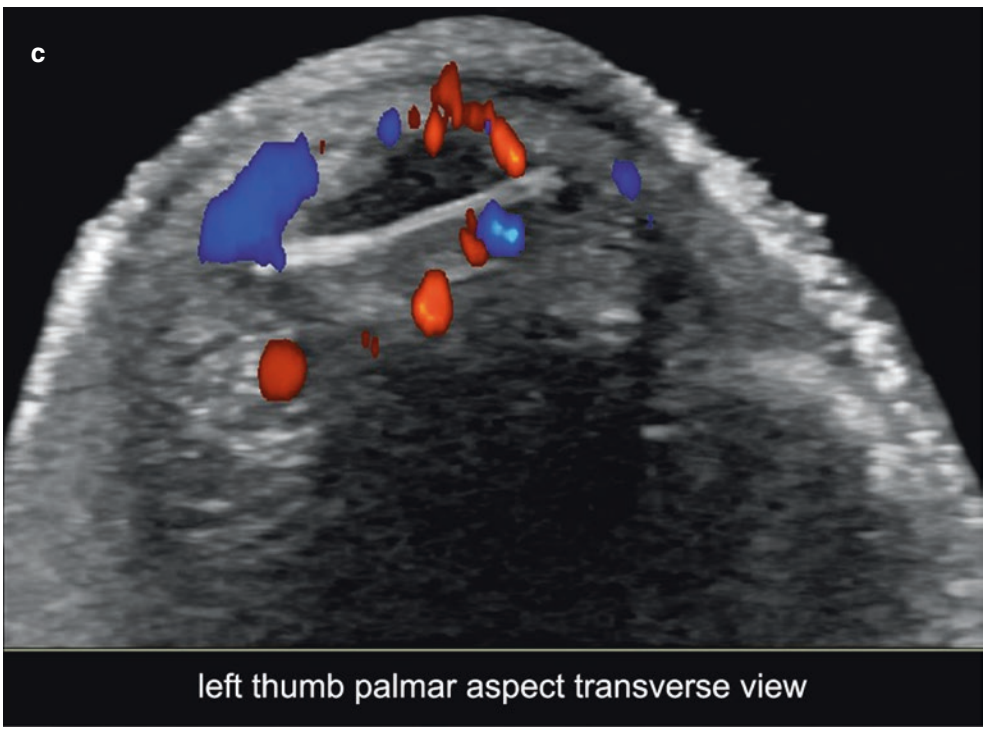


Fig. 9.42 (continued)

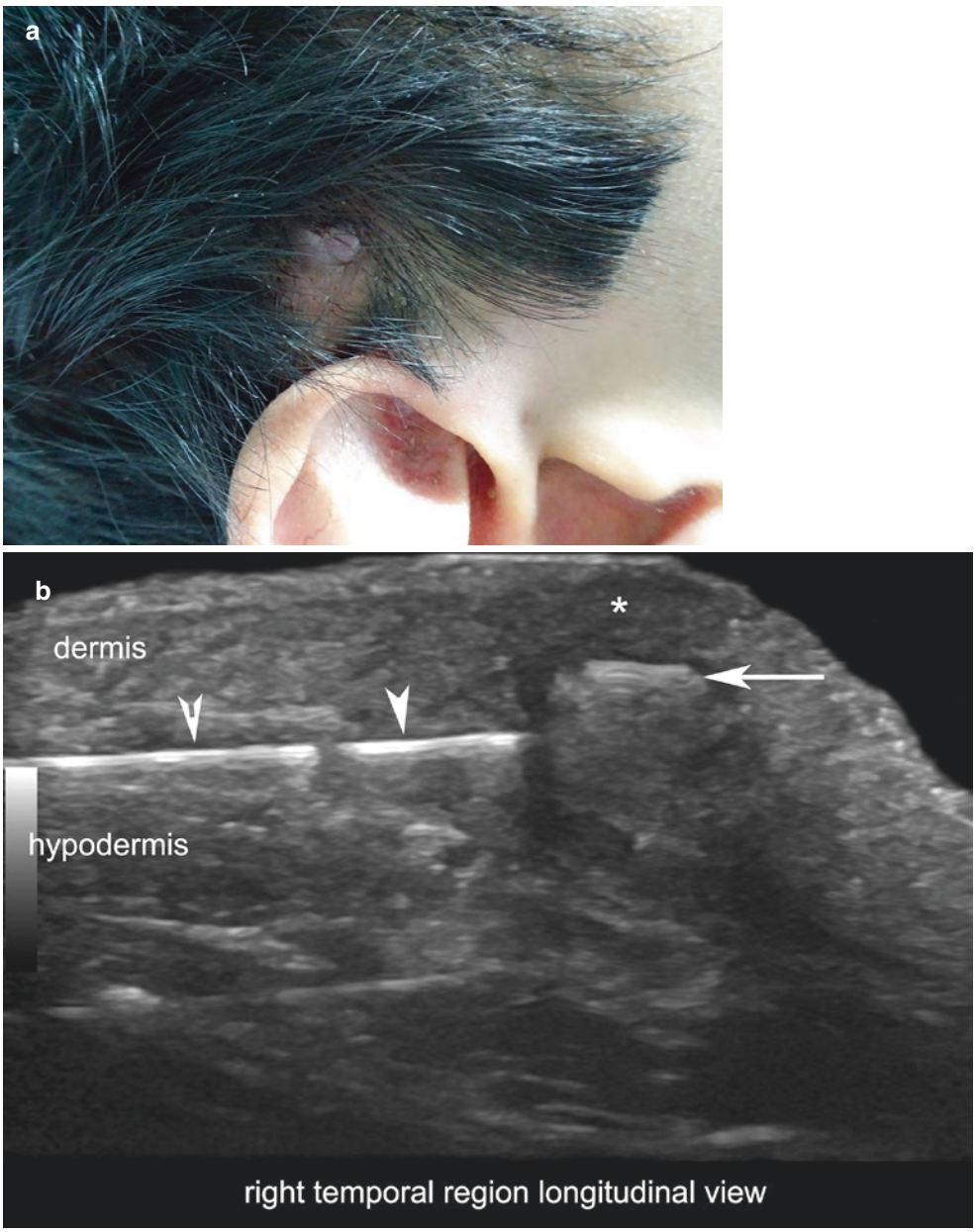


Fig. 9.43 Fragmented plaque of metal. (**a**) Clinical photograph. (**b**) Greyscale, and (**c**) color Doppler ultrasound (longitudinal view, right temporal region) demonstrates three adjacent hyperechoic hypodermal linear fragments (*arrowheads* and *arrow*) with posterior acoustic reverberance artifact and compatible with a metallic origin. One of the pieces of metal (*arrow*) is separated and protruding into the dermal layer. There is hypoechoic tissue (*asterisk*) surrounding the most superficial fragment. Color Doppler (**c**) shows increased vascularity in the periphery of the metallic fragments, which is more prominent in the periphery of the most superficial fragment of metal.

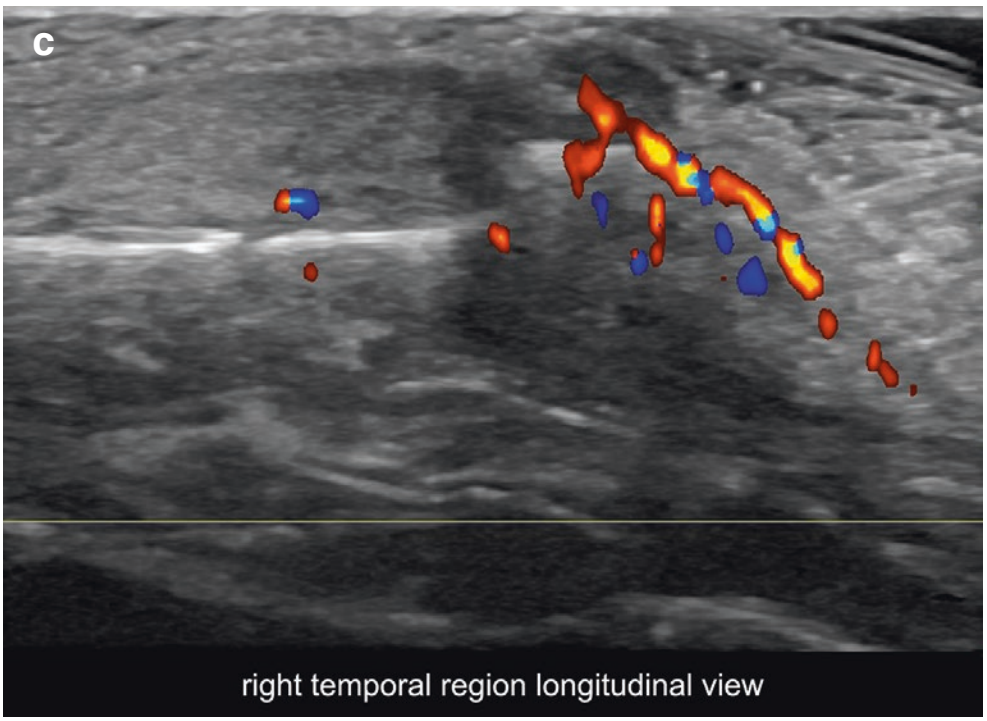


Fig. 9.43 (continued)

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