3 - Multimodal skin imaging of a dermatofibrosarcoma protuberans using line-field confocal optical coherence tomography, ultra-high frequency ultrasound and reflectance confocal microscopy

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Introduction

Dermatofibrosarcoma protuberans (DFSP) is a rare, asymptomatic, and slow-growing tumor predominantly observed on the trunk of adults aged between 30 and 50 years.[1] Primary management involves surgery, with frequent occurrences of local recurrences and rare instances of metastases.[2] DFSP has been previously characterized using ultrasound[3,4] and reflectance confocal microscopy (RCM)[5,6]. However, DFSP has never been described using line-field confocal optical coherence tomography (LC-OCT).

Clinic and dermoscopy

Our case report details a 35-year-old man presenting with a pinkish and firm plaque on his upper back (**Figure 1**). The lesion was asymptomatic and grew within a few months.

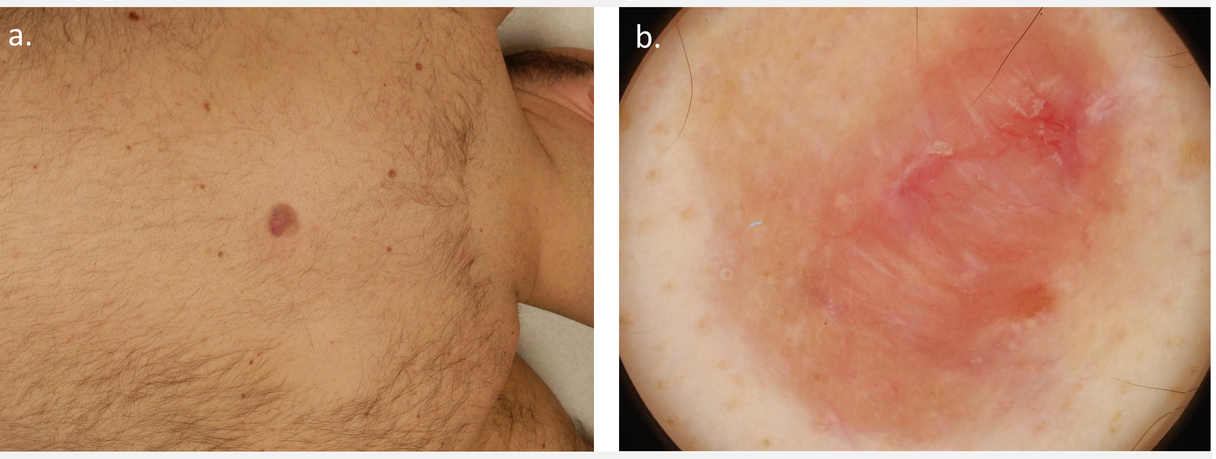

Figure 1: Clinic and dermoscopy

a. Clinical image demonstrated a pinkish plaque located on the interscapular region
b. Dermoscopy demonstrated linear and arborizing vessels, a pinkish background, multiples zones with a pigmented network and shiny white streaks

Skin imaging

Skin imaging was performed employing three different modalities: ultra-high frequency ultrasound (UHFUS), reflectance confocal microscopy (RCM), and LC-OCT **(Figure 2)**. The use of the 20MHz probe in ultrasound allowed for visualization of the entire lesion. It presented the most frequent ultrasound pattern[3] as an oval hypoechoic structure with finger-like projections and a posterior hyperechoic area. UHFUS with the 70MHz probe offered a more detailed image of the finger-like projections. RCM, with its 1µm resolution allowing cellular visualization, often showed a loss of the dermal-epidermal junction, and dense hyperreflective collagen fibers. Hyporeflective fusiform cells and hyperreflective inflammatory cells could be seen. LC-OCT, despite having a slightly lower resolution compared to RCM, offers the advantage of providing colocalized dermoscopy, three-dimensional imaging, and a penetration depth of up to 0.5mm, surpassing the 0.2mm limit of RCM. This modality allowed us to observe a hyporeflective structure invading the dermis, with dense hyperreflective collagen fibers also visible on the horizontal view.

Discussion

A skin biopsy confirmed the diagnosis of DFSP **(Figure 3)**, leading to subsequent MRI and surgical excision with 3 cm margins. This case report introduces the novel application of LC-OCT. While histopathology remains the gold standard for diagnosis, this case underscores the potential of non-invasive skin imaging for initial suspicion of DFSP. While RCM gives information at the cellular level to spot local recurrence[7], imaging depth is limited to the upper dermis. Given that recurrent DFSP is more commonly located in the deeper dermis or hypodermis[3], ultrasound and LC-OCT emerge as more effective non-invasive tools for detecting such recurrences. However, further studies are needed to determine the role of LC-OCT in the management of DFSP.

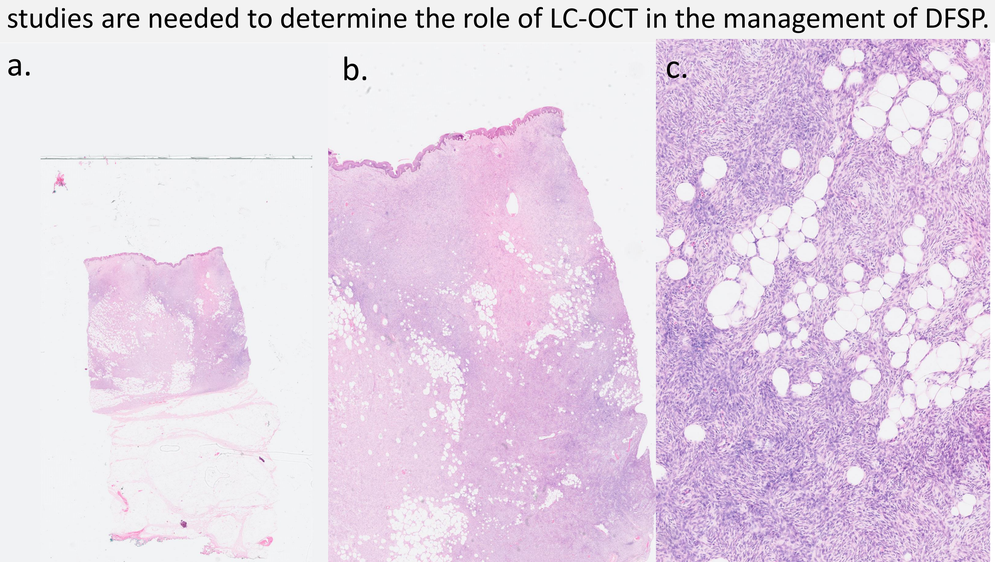

Figure 3: Pathology

a. H&E 0x.
b. H&E 12,5x.
c. H&E 100x: DFSP is composed of monomorphic spindle cells arranged in a storiform architecture, involving the dermis and infiltrating the subcanetous adipose tissue along fibrous septa, forming a honeycomb pattern. Epidermis and adnexal structures are usually spared in this condition.

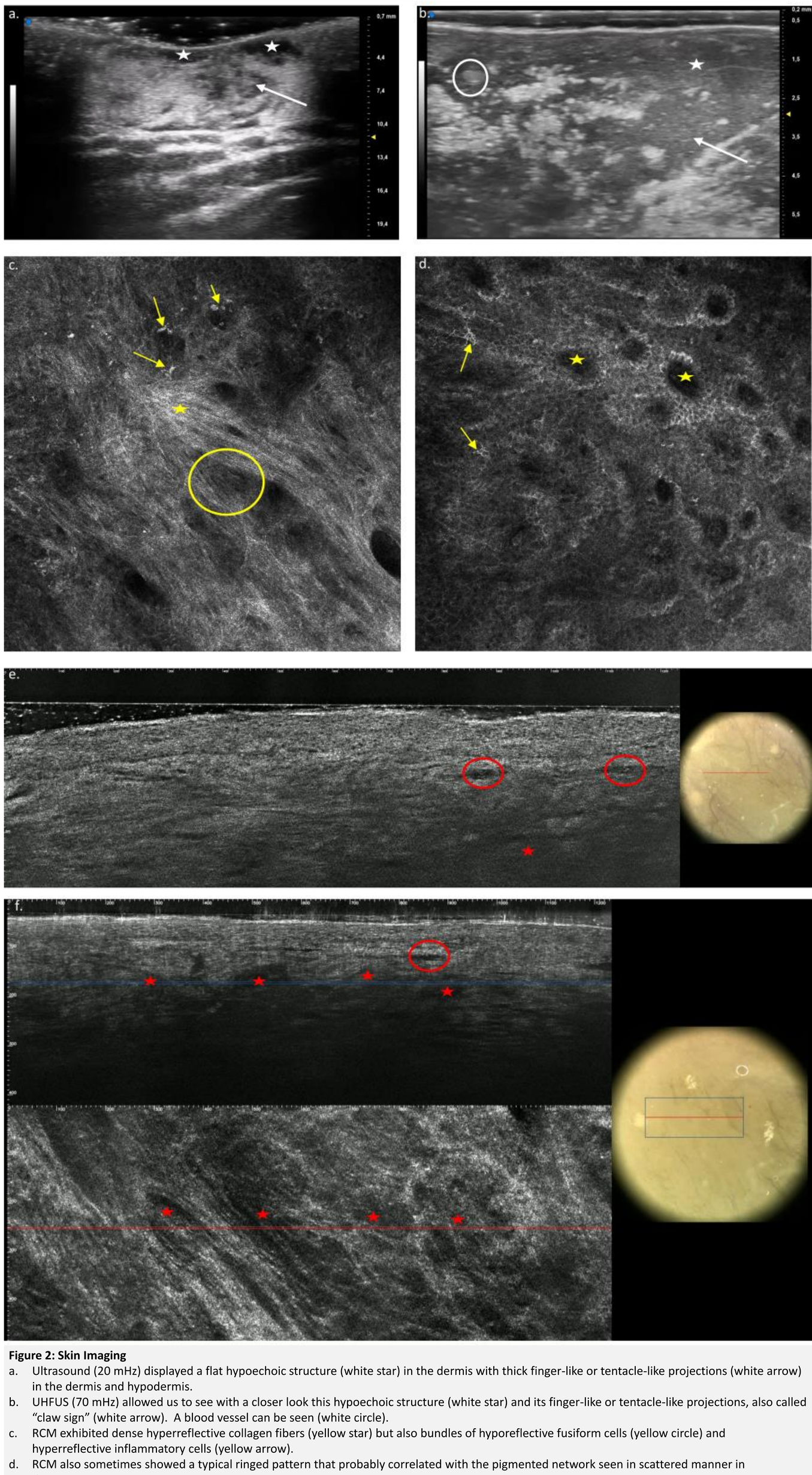

Figure 2: Skin Imaging

a. Ultrasound (20 mHz) displayed a flat hypoechoic structure (white star) in the dermis with thick finger-like or tentacle-like projections (white arrow) in the dermis and hypodermis.
b. UHFUS (70 mHz) allowed us to see with a closer look this hypoechoic structure (white star) and its finger-like or tentacle-like projections, also called "claw sign" (white arrow). A blood vessel can be seen (white circle).
c. RCM exhibited dense hyperreflective collagen fibers (yellow star) but also bundles of hyporeflective fusiform cells (yellow circle) and hyperreflective inflammatory cells (yellow arrow).
d. RCM also sometimes showed a typical ringed pattern that probably correlated with the pigmented network seen in scattered manner in dermoscopy.
e. LC-OCT (vertical view with colocalized dermoscopy) revealed a hyporeflective structure invading the dermis (red star). The pattern initially resembled the "shoal of fish" pattern seen in infiltrative basal cell carcinoma. Blood vessels containing the hyperreflective red cells can also be seen (red circle).
f. LC-OCT (three-dimensional acquisition) demonstrated how this hyporeflective structure correlated on horizontal and vertical view. Compared with RCM, the horizontal view allowed to see deeper in the dermis but the hyporeflective fusiform cells and hyperreflective inflammatory cells were not seen. The dense hyperreflective collagen fibers could also be seen.

Conclusion

This case represents the first description of DFSP using LC-OCT. While histopathology remains the gold standard, non-invasive skin imaging tools play a role in the initial assessment and in the follow-up to identify frequent recurrences. Further studies are needed to assess the role of LC-OCT in the management of DFSP.

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