# Advances in Non-Invasive Imaging for Dermatofibrosarcoma Protuberans

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## Introduction

- Dermatofibrosarcoma protuberans (DFSP) is a rare soft tissue sarcoma of the dermis, characterized by its locally aggressive and infiltrative nature. While metastasis is infrequent, it has the propensity to recur locally.[1]
- DFSP presents diagnostic challenges due to its variable clinical manifestation, and clinical observation is insufficient for the preoperative assessment of tumor extension in DFSP.
- Non-invasive imaging presents as a necessary and critical tool for managing DFSP, enhancing the precision and accuracy of diagnosis.
- A diverse array of imaging methods has emerged:
  - Ultrasound (US) & High-Frequency Doppler Ultrasound (HFUS)
  - Computed Tomography (CT)
  - Positron Emission Tomography-Computed Tomography (PET-CT)
  - Magnetic Resonance Imaging (MRI) & High-Resolution MRI (HR-MRI)
  - Magnetic Resonance Spectroscopy (MRS)
  - Optical Coherence Tomography (OCT)
  - Dermatoscopy
  - Mammography

## Objectives

1. Evaluate the role of non-invasive imaging in DFSP.
2. Comprehensively assess the strengths and limitations of the various non-invasive imaging techniques in DFSP.
3. Discuss emerging noninvasive imaging techniques in DFSP.
4. Advance dermatologic care and raise patient care standards.

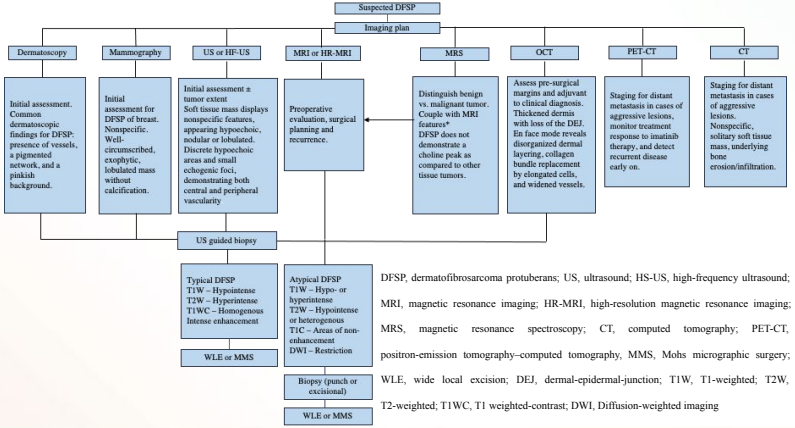
## Methods

- **SEARCH STRATEGY:**
  - Conducted a PubMed search with the following keywords:
  - "Dermatofibrosarcoma protuberans" AND one of the following search terms: "Ultrasound" (US) OR "High frequency doppler ultrasound" OR "Computed Tomography" OR "Positron emission tomography–computed tomography" OR "Magnetic resonance imaging" OR "Magnetic resonance spectroscopy" OR "Optical coherence tomography" OR "Dermatoscopy" OR "Mammography."
- **CRITERIA:**
  - Inclusion criteria: Peer-reviewed articles in English discussing non-invasive imaging for diagnosing and managing DFSP.
  - Exclusion criteria: Unrelated articles, those with insufficient information, and duplicates.

## Results

- **Ultrasound**
  - Quick, accessible, and cost-effective.
  - US is performed in cases where the clinical appearance is atypical or when clinicians need to determine their extent and depth.
  - High sensitivity (81.8%) and specificity (100%) for muscle invasion detection.
- **HFUS**
  - Demonstrated high accuracy in diagnosing tumor margins, outperforming MRI in most cases.
  - The increased blood flow observed on color doppler aids in excluding diagnoses such as cysts and lipomas, and helps distinguish DFSP from other benign tumor.[3]
- **CT**
  - Useful for anatomical location and assessing bone involvement.
  - Indicated when metastasis is suspected.[2]
- **PET-CT**
  - Allows for a comprehensive full-body examination.
  - Indicated when metastasis is suspected.[4]
- **MRI**
  - Pre-operative planning and assessing the extent of involvement, particularly with larger and atypical primary lesions or recurrent disease.
  - Superior to palpation for assessing DFSP depth with 67% sensitivity and 100% specificity.[2]
- **HR-MRI**
  - Quick, accessible, and cost-effective.
  - Offered high-resolution images, and is useful for preoperative planning.[5]
- **MRS**
  - Demonstrated high accuracy in diagnosing tumor margins, outperforming MRI in some cases, but should be used adjunctively with MRI for through assessment.
  - For soft tissue tumors, sensitivity and negative predictive value of 1H-MRS have been reported to be 94.7% and 93.8%, respectively.[6]
- **OCT**
  - Provides real-time, in-situ images of the tissue.
  - Identifies key DFSP markers: dermal thickening, DEJ loss, and disorganized layers, aiding diagnosis.[7]
- **Mammography**
  - Must include mammography in the evaluation of a suspicious breast lesion to ensure exclusion of a malignant process.
  - Mammography findings are consistent and generally demonstrate a well-circumscribed, irregular, dense mass without calcification.[8]
- **Dermatoscopy**
  - Widely available, accurate, fast, cost-effective, and easy to perform.
  - The dermatoscopic findings of vessels, a pigmented network, and a pinkish background indicate the need for prompt biopsy and aid in timely diagnosis.[9]

**Figure 1. Diagram summarizing the imaging pathway for management of DFSP**




DFSP, dermatofibrosarcoma protuberans; US, ultrasound; HS-US, high-frequency ultrasound; MRI, magnetic resonance imaging; HR-MRI, high-resolution magnetic resonance imaging; MRS, magnetic resonance spectroscopy; CT, computed tomography; PET-CT, positron-emission tomography–computed tomography, MMS, Mohs micrographic surgery; WLE, wide local excision; DEJ, dermal-epidermal-junction; T1W, T1-weighted; T2W, T2-weighted; T1WC, T1 weighted-contrast; DWI, Diffusion-weighted imaging

## Discussion

- **Integration is Key:** Utilizing a combination of imaging modalities leads to more accurate DFSP diagnoses and treatment plans.
- **Ultrasound Advantage:** Due to its high sensitivity, specificity, and cost-effectiveness, US is recommended as the first-line imaging tool.[2]
- **Advanced Imaging:** MRI and CT are crucial for detailed preoperative planning, particularly in mapping disease spread and tissue infiltration.
- **Emerging Techniques**: OCT and MRS are promising for providing unique tissue characterization, enhancing diagnostic precision.
- **Specificity Challenges**: While imaging modalities like CT and PET-CT offer valuable information, their specificity for DFSP is less clear and requires further study.
- **Dermatoscopy for Surface Assessment**: Offers rapid, non-invasive insight into surface characteristics of DFSP, helpful for initial evaluation. Can be used first line, along with US.
- **Future Focus**: More research is needed to establish standardized imaging protocols and evaluate the cost-benefit ratio of advanced imaging techniques.
  - More studies evaluating the accuracy of these imaging modalities in the setting of DFSP are needed, along with comparative studies of the imaging modalities.

## Conclusion

- DFSP is a rare soft tissue tumor characterized by asymmetrical and poorly defined growth.
  - The diagnosis and management of DFSP pose unique challenges due to its infiltrative nature and potential for local recurrence.
- Comprehensive radiological evaluation is essential
  - A multimodal approach, integrating traditional and advanced non-invasive imaging techniques, is advised for through assessment for accurate diagnosis, preoperative planning, and successful management of DFSP

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Scan for references: