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ORIGINAL ARTICLE

Current patterns of care and outcomes for dermatofibrosarcoma protuberans: An international multi-institutional collaborative

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Abstract

Background: Dermatofibrosarcoma protuberans (DFSP) is a cutaneous sarcoma with an infiltrative growth pattern that makes it challenging to clear margins. High quality data regarding DFSP natural history, management, and outcomes are limited.

Methods: Data were retrospectively collected for adult DFSP patients who underwent resection at 10 institutions in eight countries. Demographics, tumor characteristics, treatment strategies, and outcomes were analyzed.

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Results: Analysis included 347 patients consisting of young (median, 42 years), White (76.2%), males (54.2%) with truncal lesions (57.3%). The majority (76.8%) were symptomatic at presentation. Preoperative imaging was used in 55.9% of cases. Diagnosis was established with excisional biopsy in 50.9% versus incisional biopsy in 25.0% of cases. Despite planned margins of >1.0 cm in 67.4% of cases, only 69.0% of patients achieved R0 resection. Twenty-two percent of patients underwent at least one re-excision. R0 resection was achieved at a second procedure in 80.2% and a third procedure in 86.2%. Ultimately, R0 resection was feasible in 89.5% of all patients. Fibrosarcomatous transformation (FST) was observed in 12.6%. In total, 6.6% ($N = 23$) recurred (17 local, six distant). Of the six distant recurrences, 50.0% had FST. With a median follow-up of 47.0 months, disease-specific survival rate was 98.8%. In multivariable analysis, R0 margins at index resection were associated with wider circumferential margins and non-FST histology.

Conclusions: In this international, multicenter collaborative, DFSP practice patterns were heterogeneous but achieved favorable recurrence rates and survival. Multiple excisions to clear margins remain commonplace and can inform future efforts to optimize margin selection.

KEYWORDS
circumferential margins, dermatofibrosarcoma protuberans, resection, R0 status

INTRODUCTION

Dermatofibrosarcoma protuberans (DFSP) is a rare soft tissue sarcoma with an incidence of 4.1 cases per million.[1] DFSP typically presents as a firm cutaneous plaque, but histologically, it is a low-grade spindle-cell neoplasm that can produce finger-like projections extending through the subcutaneous tissues, sometimes many centimeters away from the macroscopic lesion.[2,3] As a result, DFSP is characterized by a predisposition for local invasion and local recurrence. Historically, the mainstay of treatment was wide local excision (WLE) to negative margins; however, optimal surgical approach and planned margin width remain controversial.[4,5] Particularly for extremity, head, and neck lesions, surgeons must balance the morbidity of wider margins, with the potential for injury to vital structures, difficulty with wound coverage, and poor cosmesis, against a more conservative approach, which may leave residual disease. Because of the radial growth pattern of DFSP and the challenges of achieving negative margins, accurate determination of the margin status requires expert pathologic assessment. To this end, National Comprehensive Cancer Network (NCCN) Clinical Oncology Guidelines recommend histologic peripheral and deep en face margin assessment (PDEMA) techniques, including WLE or Mohs micrographic surgery (MMS), for DFSP lesions.[6]

Considering its overall rarity, treatment challenges, and the paucity of Level I evidence to direct management, DFSP care is highly individualized and potentially varied. The objective of this study was to characterize contemporary practices of DFSP diagnosis, management, and outcomes among practitioners at experienced centers. With the ongoing debate regarding optimal margin selection, the secondary aim of this study was to understand patterns of re-excision and to identify factors associated with successful margin clearance at the time of the index operation.

MATERIALS AND METHODS

Study population

A retrospective, observational study was performed to evaluate patients undergoing surgical resection for the initial presentation of a DFSP lesion between 2003 and 2021 using a multi-institutional database developed from the following centers: Institute of Oncology Ljubljana (Ljubljana, Slovenia), Inselspital University Hospital Bern (Bern, Switzerland), Masaryk Memorial Cancer Institute (Brno, Zluty kopec, Czech Republic), Duke University Medical Center (Durham, North Carolina), National Cancer Center Hospital (Tokyo, Japan), Emory University Hospital (Atlanta, Georgia), University Hospitals Birmingham (Birmingham, United Kingdom), University Hospitals Leuven (Leuven, Belgium), The Ottawa Hospital (Ottawa, Canada), and Fox Chase Cancer Center (Philadelphia, Pennsylvania). These participants were among an initial invited group of more than 30 international centers that treat DFSP, including both surgical and dermatology practices. The study included all adult (age ≥18) patients with histologically confirmed DFSP based on biopsy or final surgical pathology. Patients who presented with recurrent DFSP treated initially at an outside institution were excluded. The study was approved by the

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institutional review board at Fox Chase Cancer Center (protocol 20-9059), as well as by all participating sites individually.

All data were transferred and stored in a secured, centralized Research Electronic Data Capture (REDCap) database for analysis by the primary site (Fox Chase Cancer Center). REDCap is a secure, web-based software platform designed to support data capture for research studies, providing 1) an intuitive interface for validated data capture; 2) audit trials for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages; and 4) procedures for data integration and interoperability with external sources.[7,8]

Data variables

Retrospective chart review was performed at each institution and collated centrally using the REDCap database. The following patient and disease characteristics were collected: age, sex, ethnicity, comorbidities, disease presentation and location, radiographic assessment, biopsy method, and histologic features. Practitioner and hospital characteristics were also provided. Operative variables and outcomes included planned radial margins, wound closure type, complication rates, margin status, number of excisions, surveillance frequency, use of multimodal adjuncts, recurrence, and death. "Planned margins," defined as the predetermined radial margins for WLE, were reported by the individual surgeons and provided as a categorical range (<0.5 cm, 0.6–1 cm, 1.1–2 cm, 2.1–3 cm, 3.1–4 cm and >4 cm). Pathologic margin assessment practices (i.e., PDEMA vs. tangential) were nonstandardized and institution specific. Margin status was reported using the R classification, where R0 indicated absence of residual microscopic tumor, R1 indicated microscopically residual tumor, and R2 referred to macroscopic residual tumor at the surgical margin. "Follow-up time" was defined as the time (months) between date of biopsy and last follow-up or death. "Time to surgery" was defined as the time (days) between biopsy and index resection. "Recurrence" was defined by each participating institution as evidence of local or distant disease after either 1) previous R0 status or 2) R1 resection followed by adjuvant radiation.

Statistical analysis

Standard descriptive statistics, including medians and interquartile ranges (IQR) for continuous variables and frequencies and proportions for categorical variables, were calculated for the entire cohort and by R0 vs R1/R2 margin groups. Wilcoxon rank sum test and Fisher exact test with simulated p value based on 2000 replicates were used to compare patient characteristics between R0 versus R1/R2 margin groups. Multivariable generalized estimating equations (GEE) logistic regression considering correlation within institutions was used to investigate the association between planned margins and R0 resection on final pathology at the time of index resection, adjusting for potential confounders, including type of institution, biopsy, imaging, practitioner, and initial histology. Data are reported as odds ratios (OR) and 95% confidence intervals (CI), and patients with missing data were excluded from analysis. A p value <.05 was considered statistically significant. All statistical analyses were performed with R (version 4.2.2, R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

Cohort demographics

The study cohort included 347 patients cared for at 10 institutions in eight countries. Institutional and individual demographics are provided in Table 1. Most patients were treated at academic centers in urban settings. The median age at presentation was 42 (32.5–54) years, of whom 54.2% were male and 76.2% were White. The majority of DFSP patients were symptomatic at presentation (76.8%). Truncal location was most common, followed by extremities and head and neck (57.3%, 30.3%, and 12.4% respectively). Although magnetic resonance imaging (MRI) was the most common preoperative imaging modality, 44.1% patients underwent no imaging before resection. Notably, radiographic practices differed by institution type and setting, with patients treated at urban or academic institutions being more likely to undergo preoperative imaging (data not shown). Approximately 50% of the cohort was diagnosed by excisional biopsy, most of which were performed by general surgeons or dermatologists. Based on preoperative biopsy, the histology was DFSP without fibrosarcomatous transformation (FST) in 92.1% of cases.

Treatment and pathologic outcomes

Surgical and histologic variables are shown in Table 2. Most patients underwent definitive resection with a surgical oncologist or other surgical specialist. The most common planned margins at index resection were 1.1–2.0 cm (32.2%), followed by 2.1–3.0 cm (23.2%). A total of 57.1% patients underwent primary tissue closure, with the remainder requiring a flap, skin graft, or delayed closure after negative pressure wound therapy. R0 resection was achieved in 69.0% of patients after index WLE. DFSP-FST was found in 12.6% of specimens based on final pathology. Of the entire cohort, 22.2% (N = 77) required a second excision (R0 achieved in 80.2% at this procedure) and 8.4% (N = 29) required a third excision (R0 achieved in 86.2% at this procedure). Ultimately, 10.5% of the entire cohort had positive microscopic margins despite surgical resection.

Use of multimodal therapy, frequency of DFSP surveillance, and recurrence data are displayed in Table 3. Systemic therapy was used in 1.5% (N = 5) patients, of whom 60% (N = 3) received imatinib. Of the 32 patients (9.4%) who received radiation, 87.5% did so in the postoperative setting. The most common postoperative surveille schema was biannual, encompassing 56.8% of patients. With a median follow-up of 47.0 months, DFSP recurred in 6.3% (N = 23; 17 local, six distant)

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TABLE 1 DFSP individual and institutional level demographic, clinical, and histologic variables ($N = 347$).

	No. (%); median (IQR)
Type of institution	
Academic	297 (86.1)
Nonacademic	19 (5.5)
Outpatient office	29 (8.4)
Region of institution	
Urban	267 (77.2)
Suburban	64 (18.5)
Rural	15 (4.3)
Age diagnosis (years)	42 (32.5–54.0)
Male sex	187 (54.2)
Race	
Asian	16 (4.7)
Black	54 (15.9)
Hispanic/Latin	7 (2.1)
White	259 (76.2)
Other	4 (1.2)
ASA class	
I	134 (38.6)
II	113 (32.6)
III	34 (9.8)
IV	2 (0.6)
Clinical presentation	
Incidental finding imaging	4 (1.2)
Incidental finding pathology	75 (22.0)
Symptomatic	262 (76.8)
Imaging modality	
None	150 (44.1)
Ultrasound	24 (7.1)
CT	56 (16.5)
MRI	96 (28.2)
Multiple modalities	14 (4.1)
Biopsy type	
FNA	3 (0.9)
Punch	52 (16.0)
Core	23 (7.1)
Incisional	81 (25.0)
Excisional	165 (50.9)
Practitioner performing biopsy	
PCP	22 (6.9)
Dermatologist	105 (33.1)
General surgeon	112 (35.3)
Surgical oncologist	14 (4.4)
Mohs surgeon	1 (0.3)
Other surgical subspecialty	51 (16.1)
Other	12 (3.8)
Location of tumor	
Head and neck	43 (12.4)
Extremities	105 (30.3)
Trunk	199 (57.3)
Initial histology	
DFSP	303 (92.1)
DFSP with FST	21 (6.4)
Other	5 (1.5)

Abbreviations: ASA, American Society of Anesthesiologists; CT, computed tomography; DFSP, dermatofibrosarcoma protuberans; FNA, fine-needle aspiration; FST, fibrosarcomatous transformation; IQR, interquartile range; MRI, magnetic resonance imaging; PCP, primary care physician.

at a median of 16.5 months after index resection among those who recurred. Of the six distant recurrences, 50.0% had FST, whereas only 5.9% of local recurrences were associated with FST. Of the 36 patients in whom final margins remained positive despite attempted extirpation, local recurrence occurred in only eight patients, none of whom received adjuvant treatment. All 17 local recurrences were managed with additional resection. Pulmonary metastases were the most common site of distant relapse ($N = 4$, 66.7%). The overall disease-specific survival rate was 98.8%.

Margin status subanalyses

To evaluate the relationship among individual, hospital, and clinical variables with margin status, DFSP patients were stratified into R0 ($N = 236$) and R1/R2 ($N = 106$) groups after their index operation, as shown in Table 4. Positive margins were associated with neither demographic factors nor tumor location, but they were more likely in patients with symptomatic clinical presentation and/or FST histology based on biopsy. Multiple provider-level factors were associated with R1 resection, including omission of preoperative imaging, biopsy type, the practitioner performing biopsy and/or resection, type and region of the institution, and circumferential margin width. Patients with positive margins were more likely to undergo adjuvant radiation without statistically significant differences in postoperative surveillance frequency, recurrence, or mortality.

Multivariable analysis to explore factors associated with R0 resection is displayed in Table 5. Covariates associated with positive

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TABLE 2 Surgical and pathologic outcomes ($N = 347$).

	No. (%); median (IQR)
Practitioner performing resection	
PCP	2 (0.6)
Dermatologist	21 (6.1)
General surgeon	52 (15.2)
Surgical oncologist	144 (42.0)
Mohs surgeon	34 (9.9)
Other surgical specialty	90 (26.2)
Time to surgery (days)	50 (22–83)
Planned margins of excision	
<0.5 cm	45 (15.1)
0.6–1.0 cm	52 (17.4)
1.1–2.0 cm	96 (32.2)
2.1–3.0 cm	69 (23.2)
3.1–4.0 cm	21 (7.0)
>4.1 cm	15 (5.0)
Wound closure	
Primary	192 (57.1)
Flap	86 (25.6)
Graft	51 (15.2)
Secondary intention/wound VAC	7 (2.1)
Postoperative complications	48 (14.2)
Margins status	
R0	236 (69.0)
R1	105 (30.7)
R2	1 (0.3)
Specimen size (cm)	
Length	4.5 (2.2–7.6)
Width	3.0 (2.0–5.5)
Depth	2.0 (1.0–3.0)
Final histology	
DFSP	288 (84.2)
DFSP with FST	43 (12.6)
No residual tumor	11 (3.2)
Planned margins 1st re-excision	
<0.5 cm	7 (7.5)
0.6–1.0 cm	38 (40.9)
1.1–2.0 cm	40 (43.0)
2.1–3.0 cm	6 (6.5)
3.1–4.0 cm	1 (1.1)
>4.1 cm	1 (1.1)
Margin status 1st re-excision	
R0	77 (80.2)
R1	19 (19.8)
Planned margins 2nd re-excision	
<0.5 cm	4 (12.9)
0.6–1.0 cm	9 (29.0)
1.1–2.0 cm	16 (51.6)
2.1–3.0 cm	1 (3.2)
3.1–4.0 cm	0 (0)
>4.1 cm	1 (3.2)
Margins status 2nd re-excision	
R0	25 (86.2)
R1	4 (13.8)

Abbreviations: DFSP, dermatofibrosarcoma protuberans; FST, fibrosarcomatous transformation; IQR, interquartile range; PCP, primary care physician; VAC, vacuum assisted closure.

margins at index resection included excisional biopsy, resection in an outpatient setting, FST histology on initial biopsy, and practitioner type (general surgeon). Compared with <1 cm margins, wider planned margins were incrementally associated with R0 resection (1–2 cm margins: odds ratio [OR], 4.90 [1.64–14.68], $p < .01$; >2 cm margins: OR, 8.67 [4.11–18.31], $p < .01$). Given this direct relationship between planned resection margins and R0 status, trends among margin width, number of excisions, R status at index operation, complication rates, and primary closure rates were examined more granularly in Table 6. Of the 97 patients with either <0.5 cm or 0.6–1.0 cm planned surgical margins, only 40% were R0 at index resection, and 24.7% ($N = 24$) underwent three excisions. By contrast, the number of required excisions fell steeply for planned margins >1 cm, with R0 rates of 83.3% and 87.0% for the 1–2 cm and 2.1–3 cm margin groups, respectively. Clinically significant postoperative complications, defined as Clavien-Dindo grade 3a or higher, were more frequent with wider margins. Whereas complications were observed in fewer than 1% of patients with margins <1 cm, complication rates peaked at 33.3% ($N = 7$) for patients with planned surgical margins of 3.1–4.0 cm. Primary closure rates were inversely related to margin width, with a primary closure rate of 20% among patients with >4.1 cm margins versus 95.6% among patients with <0.5 cm margins.

DISCUSSION

In this international, multi-institutional observational study of 347 patients who underwent initial DFSP resection between 2003 and 2021, we identified widely varied practice patterns. Approximately

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TABLE 3 Surveillance, utilization of adjuvant therapy, and oncologic outcomes ($N = 347$).

	No. (%); median (IQR)
Radiation	32 (9.4)
Neoadjuvant	2 (6.2)
Adjuvant	28 (87.5)
Palliative	2 (6.2)
Systemic therapy	5 (1.5)
Imatinib	3 (60)
Cytotoxic chemotherapy	1 (20)
Other	1 (20)
Sequence of systemic therapy	
Neoadjuvant	1 (20)
Adjuvant	4 (80)
Palliative	0 (0)
Radiation + systemic therapy	3 (0.9)
Recommended frequency follow-up	
Never	14 (4.1)
Biannual	192 (56.8)
Annual	38 (11.2)
Other	94 (27.8)
Recurrence	23 (6.6)
Local	17 (73.9)
Distant	6 (26.1)
How recurrence was found	
Routine imaging	4 (17.4)
Patient self-examination	9 (39.1)
Physician examination	9 (39.1)
New symptoms	1 (4.3)
Treatment of recurrence	
Surgery	20 (87.0)
Radiation	1 (4.3)
Systemic therapy	2 (8.7)

Abbreviation: IQR, interquartile range.

two-thirds of patients achieved an R0 resection at the index operation, and patients with positive surgical margins were more likely to undergo additional interventions, with 22.2% requiring one additional excision and 8.4% needing two additional excisions. The ability to clear disease was independently associated with the type of biopsy, practitioner, practice setting, histology, and wider circumferential margins. Ultimately, R0 resection was possible in 89.5% of cases, and oncologic outcomes were favorable regardless of original margin status and despite heterogeneity in workup, treatment, and subsequent follow-up schema. To our knowledge, this report represents the largest and most diverse series on DFSP in the contemporary literature to date.

On many fronts, our data reveal the lack of consensus in DFSP management. We found that most biopsies were done by dermatologists or general surgeons, but definitive resection was overwhelmingly performed by surgical oncologists or specialist surgeons, which could reflect either referral toward more subspecialized providers or a bias of the data set and its participating centers. This assortment of provider involvement may explain the breadth of diagnostic approaches, with utilization of preoperative imaging in a mere 55.9% of patients and use of preoperative biopsy in only 49.1% of the cohort. The former finding is consistent with multiple published series in which preoperative imaging for DFSP was routinely omitted.[9–11] Current European and US consensus guidelines do endorse punch or incisional biopsy[6] and selective use of MRI for suspected extensive subcutaneous involvement,[6,12] but the role of these modalities remain poorly understood. Early studies proposed MRI or computed tomography to delineate depth of invasion and proximity to critical structures, but there are no pathognomonic imaging findings for DFSP.[13] Although MRI is more sensitive than physical examination in determining lesion depth, it may underestimate lateral spread and/or the presence of persistent disease after extirpation.[14,15]

Postoperative surveillance strategies also ranged, with approximately one-third of patients undergoing either no follow-up or an undefined follow-up schedule. Although consensus guidelines do advocate clinical follow-up every 6–12 months, this recommendation remains debated in the literature.[6,12] Given the overall low rates of local and distant relapse, intensive surveillance for DFSP after margin-negative resection may be unnecessary.[16] The justification for this approach is that the majority of recurrences are detected clinically, rendering routine follow-up, particularly with imaging, unnecessary.[5,17] This position is consistent with our findings that fewer than 20% of recurrences were discovered with imaging, whereas nearly 80% were identified by patient or physician examination. Despite the observed wide range of practice patterns, DFSP outcomes remained favorable and on par with large population-based studies determining a 10-year relative survival of 99.1%.[1]

DFSP is notoriously challenging to resect, illuminating why this neoplasm remains a topic of international interest and debate. Historically, WLE with 2–5 cm margins was recommended to reduce local recurrence rates, which were as high as 50%.[18] However, numerous studies have challenged this dogma in favor of narrower circumferential margins with acceptably low recurrence rates of 0%–7%.[9,11,19–21] In keeping with these data, the majority of practitioners in this collaborative selected margins between 1 and 3 cm, achieving R0 resection in 69.0% of all patients at index WLE. Although multivariable analysis may suggest that incrementally wider margins improve R0 resection rates, more granular subanalysis demonstrates both the limited added oncologic benefit and increased risk of complications with >2 cm margins. We found an R0 resection rate of 83.3% for the 1.1–2.0 cm margin subgroup, which is comparable to other large series using the same margin width.[9]

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TABLE 4 Clinical, institutional, and surgical parameters according to margin status R0 versus R1/2 ($N = 342$).

	R0 ($N = 236$)	R1/R2 ($N = 106$)	*p*
Type of institution, No. (%)			<.001
Academic	217 (92.7)	75 (70.8)	
Nonacademic	7 (3.0)	12 (11.3)	
Outpatient office	10 (4.3)	19 (17.9)	
Region of institution, No. (%)			.02
Urban	190 (80.9)	73 (68.9)	
Suburban	39 (16.6)	24 (22.6)	
Rural	6 (2.6)	9 (8.5)	
Age diagnosis (years)	42 (33.0–55.0)	39 (30.3–53.8)	.20
Male sex, No. (%)	122 (51.9)	63 (60.0)	.20
Race, No. (%)			.42
Asian	13 (5.7)	3 (2.9)	
Black	40 (17.4)	14 (13.3)	
Hispanic/Latin	5 (2.2)	2 (1.9)	
White	168 (73.0)	86 (81.9)	
Clinical presentation, No. (%)			.03
Incidental finding imaging	59 (25.5)	14 (13.3)	
Incidental finding pathology	3 (1.3)	1 (1.0)	
Symptomatic	169 (73.3)	90 (85.7)	
Imaging modality, No. (%)			.002
None	88 (38.3)	60 (57.1)	
Ultrasound	13 (5.7)	11 (10.5)	
CT	42 (18.3)	14 (13.3)	
MRI	76 (33.0)	17 (16.2)	
Multiple modalities	11 (4.8)	3 (2.9)	
Biopsy type, No. (%)			.010
FNA	3 (1.4)	0 (0.0)	
Punch	41 (18.6)	11 (11.1)	
Core	17 (7.7)	6 (6.1)	
Incisional	62 (28.1)	17 (17.2)	
Excisional	98 (44.3)	65 (65.7)	
Practitioner performing biopsy, No. (%)			.012
PCP	14 (6.5)	7 (7.3)	
Dermatologist	82 (37.8)	22 (22.9)	
General surgeon	65 (30.0)	46 (47.9)	
Surgical oncologist	9 (4.1)	5 (5.2)	
Mohs surgeon	0 (0.0)	1 (1.0)	
Other surgical subspecialty	39 (18.0)	11 (11.5)	
Other	8 (3.7)	4 (4.2)	

(Continues)

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TABLE 4 (Continued)

	R0 (*N* = 236)	R1/R2 (*N* = 106)	*p*
Location of tumor, No. (%)			.57
Head and neck	26 (11.0)	16 (15.1)	
Extremities	72 (30.5)	31 (29.2)	
Trunk	138 (58.5)	59 (55.7)	
Initial histology, No. (%)			.04
DFSP	218 (92.8)	95 (89.6)	
DFSP with FST	11 (4.7)	11 (10.4)	
Other	6 (2.6)	0 (0.0)	
Time to surgery (days)	58 (34.5–89.0)	25 (0–57.5)	<.001
Practitioner performing resection, No. (%)			<.001
PCP	1 (0.4)	1 (1.0)	
Dermatologist	10 (4.3)	11 (10.5)	
General surgeon	12 (5.2)	40 (38.1)	
Surgical oncologist	124 (53.2)	20 (19.0)	
Mohs surgeon	22 (9.4)	11 (10.5)	
Other surgical specialty	64 (27.5)	22 (21.0)	
Planned margins of excision, No. (%)			<.001
<0.5 cm	17 (8.1)	28 (33.3)	
0.6–1.0 cm	22 (10.5)	29 (34.5)	
1.1–2.0 cm	80 (38.1)	16 (19.0)	
2.1–3.0 cm	60 (28.6)	9 (10.7)	
3.1–4.0 cm	18 (8.6)	2 (2.4)	
>4.1 cm	13 (6.2)	0 (0.0)	
Wound closure, No. (%)			.001
Primary	116 (50.4)	75 (73.5)	
Flap	69 (30.0)	16 (15.7)	
Graft	40 (17.4)	9 (8.8)	
Secondary intention/wound VAC	5 (2.2)	2 (2.0)	
Postoperative complications	41 (17.6)	7 (6.7)	.007
Final histology, No. (%)			.20
DFSP	196 (84.1)	88 (83.8)	
DFSP with FST	27 (11.6)	16 (15.2)	
No residual tumor	10 (4.3)	1 (1.0)	
Specimen size (cm)			
Length	5.0 (2.4–9.5)	3.2 (2.0–5.9)	.002
Width	3.4 (2.0–6.0)	2.0 (1.5–3.9)	<.001
Depth	2.0 (1.0–3.5)	1.5 (1.0–2.0)	.010
Radiation, No. (%)	17 (7.3)	15 (14.4)	.046
Systemic therapy, No. (%)	3 (1.3)	2 (1.9)	.65
Recurrence, No. (%)	12 (5.1)	11 (10.4)	.10

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TABLE 4 (Continued)

	R0 (*N* = 236)	R1/R2 (*N* = 106)	*p*
Type of recurrence, No. (%)			.64
Local	8 (66.7)	9 (81.8)	
Distant	4 (33.3)	2 (18.2)	
Frequency of follow-up recommended, No. (%)			.31
Never	12 (5.2)	2 (1.9)	
Biannual	130 (56.3)	61 (59.0)	
Annual	23 (10.0)	15 (14.6)	
Other	66 (28.6)	25 (24.3)	
Mortality, No. (%)	14 (6.0)	4 (3.9)	.065

Abbreviations: CT, computed tomography; DFSP, dermatofibrosarcoma protuberans; FNA, fine-needle aspiration; FST, fibrosarcomatous transformation; MRI, magnetic resonance imaging; PCP, primary care physician; VAC, vacuum assisted closure.

TABLE 5 Multivariable generalized estimating equations logistic regression to predict achieving negative margins at index DFSP excision (*N* = 269).

Covariate	OR	CI	*p*
Type of institution (academic ref)			
Nonacademic	0.53	0.17–1.64	.27
Outpatient office	0.40	0.21–0.74	<.01
Biopsy type (incisional ref)			
Core	0.45	0.13–1.57	.21
Excisional	0.41	0.24–0.70	<.01
Punch	0.53	0.22–1.29	.16
Preoperative imaging performed	0.88	0.40–1.93	.74
Practitioner (surgical oncologist ref)			
Dermatologist/Mohs	0.53	0.14–2.04	.36
General surgeon	0.18	0.08–0.42	<.01
Other specialist	0.62	0.20–1.91	.41
Planned margins (≤1.0 cm ref)			
1.1–2 cm	4.90	1.64–14.68	<.01
>2 cm	8.67	4.11–18.31	<.01
Initial histology DFSP with FST (DFSP ref)	0.20	0.06–0.64	.01

Abbreviations: CI, confidence interval; DFSP, dermatofibrosarcoma protuberans; FST, fibrosarcomatous transformation; OR, odds ratio; ref, reference.

The paradigm shift toward narrower margins is supported by data that complete histologic margin assessment, rather than more aggressive resection, can improve disease clearance and render local recurrence near obsolete.[9,19] In fact, historically high rates of recurrence were likely due to unrecognized persistent disease at the surgical margin.[22] PDEMA encompasses a variety of techniques for visualizing and interpreting the entire surface of a surgical specimen. Successful PDEMA depends on proper specimen orientation and communication with the pathologist to successively excise positive margins until either all cancer is removed or further excision is not anatomically possible.[23–25] Considering the generally lower recurrence rates with PDEMA as compared to routine margin assessment, the NCCN Guidelines recommend PDEMA techniques by either WLE or MMS as first-line treatment for DFSP.[6,11,19,23,26–32]

Finally, this study demonstrated that practitioner type, excisional biopsy, and outpatient practice setting were each associated with risk of positive margins after index resection. Collectively, these findings may hint at providers' low baseline suspicion for DFSP at the time of excision and recapitulate previous reports showing that, in the absence of pathologic confirmation, more excisions are typically warranted.[5] We also identified higher rates of biopsy-proven FST among patients with index R1 resections. Characterized by a loss of CD34 expression and increased hypercellularity, mitoses, and atypia, FST affects up to 20% of DFSP patients and is associated with local recurrence, distant disease, and poorer survival.[5,33–35] Consistent with our findings, Alshaygy et al.[16] demonstrated greater rates of positive margins, as well as local and distant recurrence, in FST compared with non-FST DFSP patients. One possible explanation for the higher rates of R1 resection is that transformed lesions tend to be larger, suggesting a potential role for wider planned margins in this more biologically aggressive variant.[5] Considering that FST patients are often excluded from retrospective analyses, further studies are needed to determine how best to manage this specific population of DFSP patients.

There are several limitations to this study, in addition to its retrospective design and the potential biases of representing mostly academic centers with vast heterogeneity of patient referral and diagnostic approach. First, the database included patients who underwent definitive resection by both Mohs surgeons and dermatologists, although the number of patients who underwent true MMS is unknown. Because WLE and MMS techniques diverge in how they achieve R0 resection, inclusion of any MMS patients may confound analysis. However, because patients treated by Mohs surgeons represented less than 10% of the entire cohort and excluding them from

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TABLE 6 DFSP planned radial margins, number of excisions, resultant margin status, and surgical morbidity of index excision.

		No. of excisions, No. (%)			Margin status of index excision			
Margin of excision (cm)	No. ($N = 298$)	1	2	3	R0	R1	% Complication[a]	% Primary closure
<0.5	45	16 (35.6)	20 (44.4)	9 (20.0)	17 (37.8)	28 (62.2)	0 (0)	43 (95.6)
0.6–1.0	52	14 (26.9)	23 (44.2)	15 (28.8)	22 (43.1)	29 (56.9)	1 (1.9)	35 (67.3)
1.1–2.0	96	82 (85.4)	13 (13.5)	2 (1.0)	80 (83.3)	16 (16.7)	7 (7.2)	48 (50.0)
2.1–3.0	69	64 (92.8)	4 (5.8)	1 (1.4)	60 (87.0)	9 (13.0)	10 (14.5)	30 (43.5)
3.1–4.0	21	20 (95.2)	1 (4.8)	0 (0.0)	18 (90.0)	2 (10.0)	7 (33.3)	7 (33.3)
>4.1	15	14 (93.3)	1 (6.7)	0 (0.0)	13 (100)	0 (0.0)	2 (13.3)	3 (20.0)

Abbreviation: DFSP, dermatofibrosarcoma protuberans.

[a]Complications were defined as Clavien-Dindo grades 3a or higher.

multivariate analysis generated the exact same trends (data not shown), the larger GEE cohort remains valid. Second, the data set did not include primary lesion size, an important factor in the clinical management of DFSP, so our multivariable model for predicting index R0 status was not adjusted for this variable. Third, histologic assessment was nonstandardized across institutions, and not all participating centers used PDEMA, meaning the data set may underreport R1 resections and/or overrepresent recurrences due to incompletely evaluated, persistent disease. In addition, the long study duration may have introduced variability in pathologic assessment, and there was no central pathologic review to verify DFSP diagnosis before inclusion. Finally, because disease recurrence and death are rare events for DFSP, we were unable to draw meaningful conclusions about how practice patterns influenced these outcomes.

Over a nearly 20-year multi-institutional, international experience with DFSP, oncologic outcomes were quite favorable despite wide-ranging practice patterns, namely, diagnostic approaches and selection of surgical margins. R0 resection was feasible in 89.5% of all DFSP patients, although at least two excisions were required in greater than 20% of cases. The ability to clear disease at the index resection was associated with non-FST histology and wider margins, but true rates of R0 resection may be misrepresented due to lack of complete margin assessment at all centers. Further efforts should focus on international collaboration and education to better standardize surgical approach, patient selection, and pathologic assessment techniques for DFSP.

AUTHOR CONTRIBUTIONS

Leah K. Winer: Writing–original draft, writing–review and editing, formal analysis, and methodology. **Rita Akumuo**: Project administration, data curation, and writing–review and editing. **Jordan D. Fredette**: Writing–review and editing, software, formal analysis, methodology, and validation. **Mengying Deng**: Methodology, validation, formal analysis, and software. **Jill S. Hasler**: Validation and formal analysis. **Stephanie H. Greco**: Investigation, writing–review and editing, data curation, and conceptualization. **Margaret von Mehren**: Investigation, writing–review and editing, conceptualization, supervision, and data curation. **Alex J. Bartholomew**: Conceptualization, investigation, writing–review and editing, and data curation. **Dan G. Blazer**: Conceptualization, investigation, writing–review and editing, and data curation. **Lucie Gabrielova**: Writing–review and editing, conceptualization, and data curation. **Dagmar Adamkova**: Data curation, writing–review and editing, and conceptualization. **Ericka Bernard-Bedard**: Data curation, conceptualization, and writing–review and editing. **Carolyn Nessim**: Data curation, conceptualization, and writing–review and editing. **Attila Kollar**: Conceptualization, writing–review and editing, and data curation. **Radu Olariu**: Conceptualization, writing–review and editing, and data curation. **Romi Cencelj-Arnez**: Conceptualization, writing–review and editing, and data curation. **Daphne Hompes**: Conceptualization, writing–review and editing, and data curation. **Samuel J. Ford**: Conceptualization, writing–review and editing, and data curation. **Kenneth Cardona**: Conceptualization, writing–review and editing, and data curation. **Kenji Sato**: Conceptualization, writing–review and editing, and data curation. **Shintaro Iwata**: Conceptualization, data curation, and writing–review and editing. **Jeffrey M. Farma**: Conceptualization, investigation, writing–review and editing, methodology, data curation, and supervision. **Anthony M. Villano**: Conceptualization, investigation, writing–review and editing, methodology, formal analysis, project administration, supervision, and resources. All authors assisted with revision and approval of the final manuscript.

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CONFLICT OF INTEREST STATEMENT

Romi Cencelj-Arnez reports consulting fees from the Institut of Oncology, Ljubljana. Attila Kollar reports consulting fees from the

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University Hospital, Inselspital. The other authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author on reasonable request.

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REFERENCES

1. Kreicher KL, Kurlander DE, Gittleman HR, Barnholtz-Sloan JS, Bordeaux JS. Incidence and survival of primary dermatofibrosarcoma protuberans in the United States. *Dermatol Surg*. 2016;42(suppl 1):S24-S31. doi:10.1097/DSS.0000000000000300
2. Ratner D, Thomas CO, Johnson TM, et al. Mohs micrographic surgery for the treatment of dermatofibrosarcoma protuberans. Results of a multiinstitutional series with an analysis of the extent of microscopic spread. *J Am Acad Dermatol*. 1997;37(4):600-613. doi:10.1016/s0190-9622(97)70179-8
3. Vitiello GA, Lee AY, Berman RS. Dermatofibrosarcoma protuberans: what is this? *Surg Clin North Am*. 2022;102(4):657-665. doi:10.1016/j.suc.2022.05.004
4. Bowne WB, Antonescu CR, Leung DH, et al. Dermatofibrosarcoma protuberans: a clinicopathologic analysis of patients treated and followed at a single institution. *Cancer*. 2000;88(12):2711-2720. doi:10.1002/1097-0142(20000615)88:12<2711::aid-cncr9>3.0.co;2-m
5. Huis In't Veld EA, van Coevorden F, Grunhagen DJ, et al. Outcome after surgical treatment of dermatofibrosarcoma protuberans: Is clinical follow-up always indicated? *Cancer*. 2019;125(5):735-741. doi:10.1002/cncr.31924
6. National Comprehensive Cancer Network. NCCN clinical practice guidelines in oncology. dermatofibrosarcoma protbuerans. Version 1, 2023. *National Comprehensive Cancer Network*. Accessed April 22, 2023. https://www.nccn.org/professionals/physician_gls/pdf/dfsp.pdf
7. Harris PA, Taylor R, Minor BL, et al. The REDCap consortium: building an international community of software platform partners. *J Biomed Inform*. 2019;95:103208. doi:10.1016/j.jbi.2019.103208
8. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)--a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform*. 2009;42(2):377-381. doi:10.1016/j.jbi.2008.08.010
9. Farma JM, Ammori JB, Zager JS, et al. Dermatofibrosarcoma protuberans: how wide should we resect? *Ann Surg Oncol*. 2010;17(8):2112-2118. doi:10.1245/s10434-010-1046-8
10. Houdek MT, Tsoi KM, Mallett KE, et al. Surgical outcomes of primary dermatofibrosarcoma protuberans: a retrospective, multicenter study. *Ann Surg Oncol*. 2022;29(13):8632-8638. doi:10.1245/s10434-022-12351-0
11. Meguerditchian AN, Wang J, Lema B, Kraybill WG, Zeitouni NC, Kane JM. 3rd. Wide excision or Mohs micrographic surgery for the treatment of primary dermatofibrosarcoma protuberans. *Am J Clin Oncol*. 2010;33(3):300-303. doi:10.1097/COC.0b013e3181aaca87
12. Saiag P, Grob JJ, Lebbe C, et al. Diagnosis and treatment of dermatofibrosarcoma protuberans. European consensus-based interdisciplinary guideline. *Eur J Cancer*. 2015;51(17):2604-2608. doi:10.1016/j.ejca.2015.06.108
13. Kransdorf MJ, Meis-Kindblom JM. Dermatofibrosarcoma protuberans: radiologic appearance. *AJR Am J Roentgenol*. 1994;163(2):391-394. doi:10.2214/ajr.163.2.8037038
14. Humphreys TR, Shah K, Wysong A, Lexa F, MacFarlane D. The role of imaging in the management of patients with nonmelanoma skin cancer: when is imaging necessary? *J Am Acad Dermatol*. 2017;76(4):591-607. doi:10.1016/j.jaad.2015.10.009
15. Serra-Guillen C, Sanmartin O, Llombart B, et al. Correlation between preoperative magnetic resonance imaging and surgical margins with modified Mohs for dermatofibrosarcoma protuberans. *Dermatol Surg*. 2011;37(11):1638-1645. doi:10.1111/j.1524-4725.2011.02077.x
16. Alshaygy I, Mattei JC, Basile G, et al. Outcome after surgical treatment of dermatofibrosarcoma protuberans (DFSP): does it require extensive follow-up and what is an adequate resection margin? *Ann Surg Oncol*. 2023;30(5):3106-3113. doi:10.1245/s10434-022-12953-8
17. Gladdy RA, Wunder JS. Risk-stratified surveillance in dermatofibrosarcoma protuberans: less is more. *Cancer*. 2019;125(5):670-672. doi:10.1002/cncr.31922
18. Monnier D, Vidal C, Martin L, et al. Dermatofibrosarcoma protuberans: a population-based cancer registry descriptive study of 66 consecutive cases diagnosed between 1982 and 2002. *J Eur Acad Dermatol Venereol*. 2006;20(10):1237-1242. doi:10.1111/j.1468-3083.2006.01780.x
19. DuBay D, Cimmino V, Lowe L, Johnson TM, Sondak VK. Low recurrence rate after surgery for dermatofibrosarcoma protuberans: a multidisciplinary approach from a single institution. *Cancer*. 2004;100(5):1008-1016. doi:10.1002/cncr.20051
20. Heuvel ST, Suurmeijer A, Pras E, Van Ginkel RJ, Hoekstra HJ. Dermatofibrosarcoma protuberans: recurrence is related to the adequacy of surgical margins. *Eur J Surg Oncol*. 2010;36(1):89-94. doi:10.1016/j.ejso.2009.07.006
21. Snow H, Davies E, Strauss DC, Smith M, Hayes AJ. Conservative re-excision is a safe and simple alternative to radical resection in revision surgery for dermatofibrosarcoma protuberans. *Ann Surg Oncol*. 2020;27(3):919-923. doi:10.1245/s10434-019-08011-5
22. Zager JS, Bui MM, Farma JM, Messina JL, Sondak VK. Proper margins of excision in dermatofibrosarcoma protuberans: wide or narrow? *Ann Surg Oncol*. 2008;15(9):2614-2616. doi:10.1245/s10434-008-9922-1
23. Gloster HM Jr., Harris KR, Roenigk RK. A comparison between Mohs micrographic surgery and wide surgical excision for the treatment of dermatofibrosarcoma protuberans. *J Am Acad Dermatol*. 1996;35(1):82-87.
24. Leigheb M, Zavattaro E, Bellinzona F, Furlan G, Leigheb G. Micrographic surgery (Tubingen torte technique) for the treatment of an invasive dermatofibrosarcoma protuberans with muscular involvement. *G Ital Dermatol Venereol*. 2010;145(2):309-311.
25. Mohrle M, Breuninger H. [The Muffin technique--an alternative to Mohs' micrographic surgery]. *J Dtsch Dermatol Ges*. 2006;4(12):1080-1084. doi:10.1111/j.1610-0387.2006.06152.x
26. Bogucki B, Neuhaus I, Hurst EA. Dermatofibrosarcoma protuberans: a review of the literature. *Dermatol Surg*. 2012;38(4):537-551. doi:10.1111/j.1524-4725.2011.02292.x
27. Durack A, Gran S, Gardiner MD, et al. A 10-year review of surgical management of dermatofibrosarcoma protuberans. *Br J Dermatol*. 2021;184(4):731-739. doi:10.1111/bjd.19346
28. Foroozan M, Sei JF, Amini M, Beauchet A, Saiag P. Efficacy of Mohs micrographic surgery for the treatment of dermatofibrosarcoma protuberans: systematic review. *Arch Dermatol*. 2012;148(9):1055-1063. doi:10.1001/archdermatol.2012.1440
29. Lowe GC, Onajin O, Baum CL, et al. A comparison of Mohs micrographic surgery and wide local excision for treatment of dermatofibrosarcoma protuberans with long-term follow-up: the Mayo Clinic

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experience. *Dermatol Surg*. 2017;43(1):98-106. doi:10.1097/DSS.0000000000000910

30. Malan M, Xuejingzi W, Quan SJ. The efficacy of Mohs micrographic surgery over the traditional wide local excision surgery in the cure of dermatofibrosarcoma protuberans. *Pan Afr Med J*. 2019;33:297. doi:10.11604/pamj.2019.33.297.17692
31. Paradisi A, Abeni D, Rusciani A, et al. Dermatofibrosarcoma protuberans: wide local excision vs. Mohs micrographic surgery. *Cancer Treat Rev*. 2008;34(8):728-736. doi:10.1016/j.ctrv.2008.06.002
32. Veronese F, Boggio P, Tiberio R, et al. Wide local excision vs. Mohs Tubingen technique in the treatment of dermatofibrosarcoma protuberans: a two-centre retrospective study and literature review. *J Eur Acad Dermatol Venereol*. 2017;31(12):2069-2076. doi:10.1111/jdv.14378
33. Navarrete-Dechent C, Mori S, Barker CA, Dickson MA, Nehal KS. Imatinib treatment for locally advanced or metastatic dermatofibrosarcoma protuberans: a systematic review. *JAMA Dermatol*. 2019;155(3):361-369. doi:10.1001/jamadermatol.2018.4940
34. Liang CA, Jambusaria-Pahlajani A, Karia PS, Elenitsas R, Zhang PD, Schmults CD. A systematic review of outcome data for dermatofibrosarcoma protuberans with and without fibrosarcomatous change. *J Am Acad Dermatol*. 2014;71(4):781-786. doi:10.1016/j.jaad.2014.03.018
35. Abbott JJ, Oliveira AM, Nascimento AG. The prognostic significance of fibrosarcomatous transformation in dermatofibrosarcoma protuberans. *Am J Surg Pathol*. 2006;30(4):436-443. doi:10.1097/00000478-200604000-00002

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