

Accuracy of Preoperative Imaging in Assessing the involvement of the Deep Periosteal Margin in Dermatofibrosarcoma Protuberans of the Scalp: The Mayo Clinic Experience

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ABSTRACT

BACKGROUND

Dermatofibrosarcoma protuberans (DFSP) of the scalp may infiltrate the periosteum, calvarium, dura or brain. Preoperative imaging (CT and/or MRI) can show calvarial bone abnormalities, but it remains to be seen whether these abnormalities correlate with the positive deep periosteal margins at excision.

OBJECTIVE

We sought to examine the accuracy of preoperative CT/MRI in assessment of the deep margin and whether preoperative calvarial bone abnormalities correlate with the involvement of the deep periosteal margin.

METHODS

A retrospective medical record and image review was done of all patients with DFSP of the scalp treated at a quaternary referral center. Data collected included demographic, gross tumor characteristics, preoperative imaging findings, and status of the deep periosteal margin (involved versus non-involved).

RESULTS

A total of 33 (19 [57.6%] male) patients were diagnosed with DFSP of the scalp at a mean age of 37 years (range: 6-88 years). Preoperative imaging was done in 26 (78.8%) patients (CT only in 5, MRI only in 12, both in 9). Calvarial bone abnormalities were detected in 3 (11.5%) patients (CT = 2, MRI = 3). The sensitivity and positive predictive value (PPV) of bone abnormalities detected on CT scan in determining involvement of the periosteal margin were 25% and 100% respectively. The sensitivity and PPV of MRI were 33% and 100% respectively. The specificity and negative predictive (NPV) value of CT scan were 100 % and 50% respectively. The specificity and NPV of MRI were 100% and 66%.

CONCLUSIONS

Calvarial bone abnormalities detected on preoperative CT and MRI are highly predictive of the involvement of the periosteal margin at surgical excision with a 100% specificity and PPV. A normal appearing bone on preoperative imaging doesn't rule out the possibility of periosteal involvement.

OBJECTIVES

Preoperative imaging plays a large role in planning for resection of DFSP over the scalp; however, it is unknown the exact utility of these imaging modalities in being predictive of the involvement of the periosteum.

We present a retrospective case series of 33 cases of DFSP of the scalp with emphasis on the preoperative imaging findings.

METHODS

A retrospective medical record review for all patients treated for DFSP of the scalp at the Mayo Clinic between January 1998 and May 2023.

All cases had histopathologic diagnosis

Patient data including demographics, tumor characteristics, preoperative imaging findings, surgical management, additional treatment modalities and outcomes were evaluated.

For cases of incomplete excision or biopsied lesions, only the location of the tumor was collected. Preoperative imaging was done at the clinician's discretion and included magnetic resonance imaging (MRI) or computerized tomography (CT). Information regarding the radiological findings were collected from the radiologist's reports and an additional independent radiologist review (author JG)

RESULTS

- A total of 33 patients (19 Male, 57.6%) were identified with scalp DFSP; 29 were primary lesions, whereas 4 were recurrences. Mean age of patients at diagnosis was 37 years (range 6-88 years).
- The most common region affected by the tumor was the frontal scalp (n=12) followed by the occipital scalp (n=9), parietal scalp (n=7), temporal scalp (n=3). In two patients, the primary tumor was limited to the retroauricular region.

RESULTS

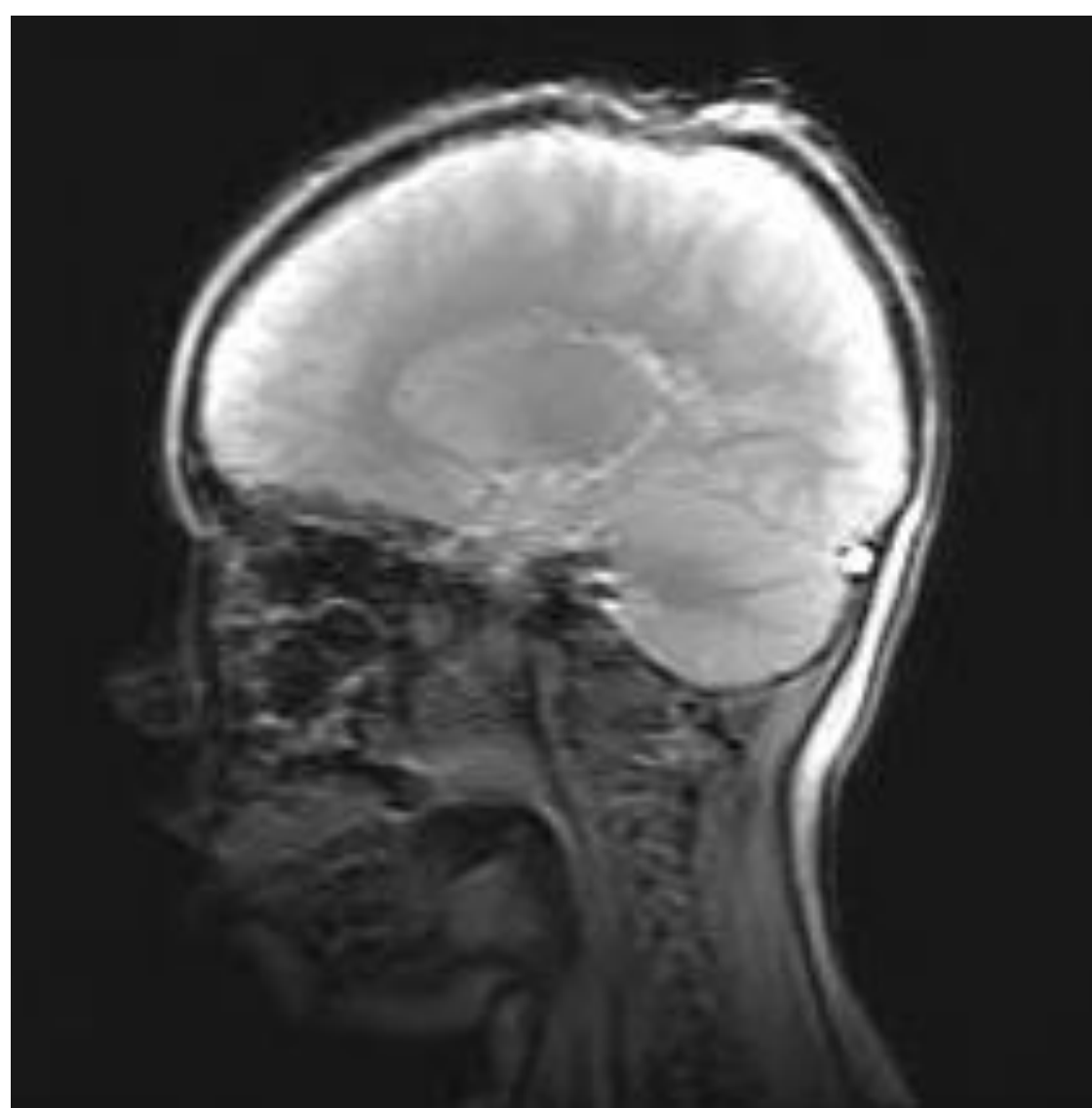
- Median tumor size was 9.0 cm², range of 1.56cm – 87.30 cm²
- 22 patients (67.6%) underwent Mohs micrographic surgery, and Wide local excision was used in 11 patients (33.3%).
- Complete resection with negative deep margins was achieved above the periosteum in 11 out of 33 patients . Out of the remaining 22 patients with periosteal involvement or resection, information related to the status of periosteal involvement was available in 19 (57.6 %) patients, of which the deep periosteal margin was positive in 10 (52.6%) patients.

FIGURE 1

Bone Abnormalities	Periosteal Positivity		
	CT Findings	+	-
		2 (TP)	0 (FP)
	+		
	-	6 (TN)	6 (FN)

Comparison of Imaging Findings and Periosteal Positivity in CT and MRI (TP – True Positive, FP – False Positive, TN – True Negative, FN – False Negative

FIGURE 2

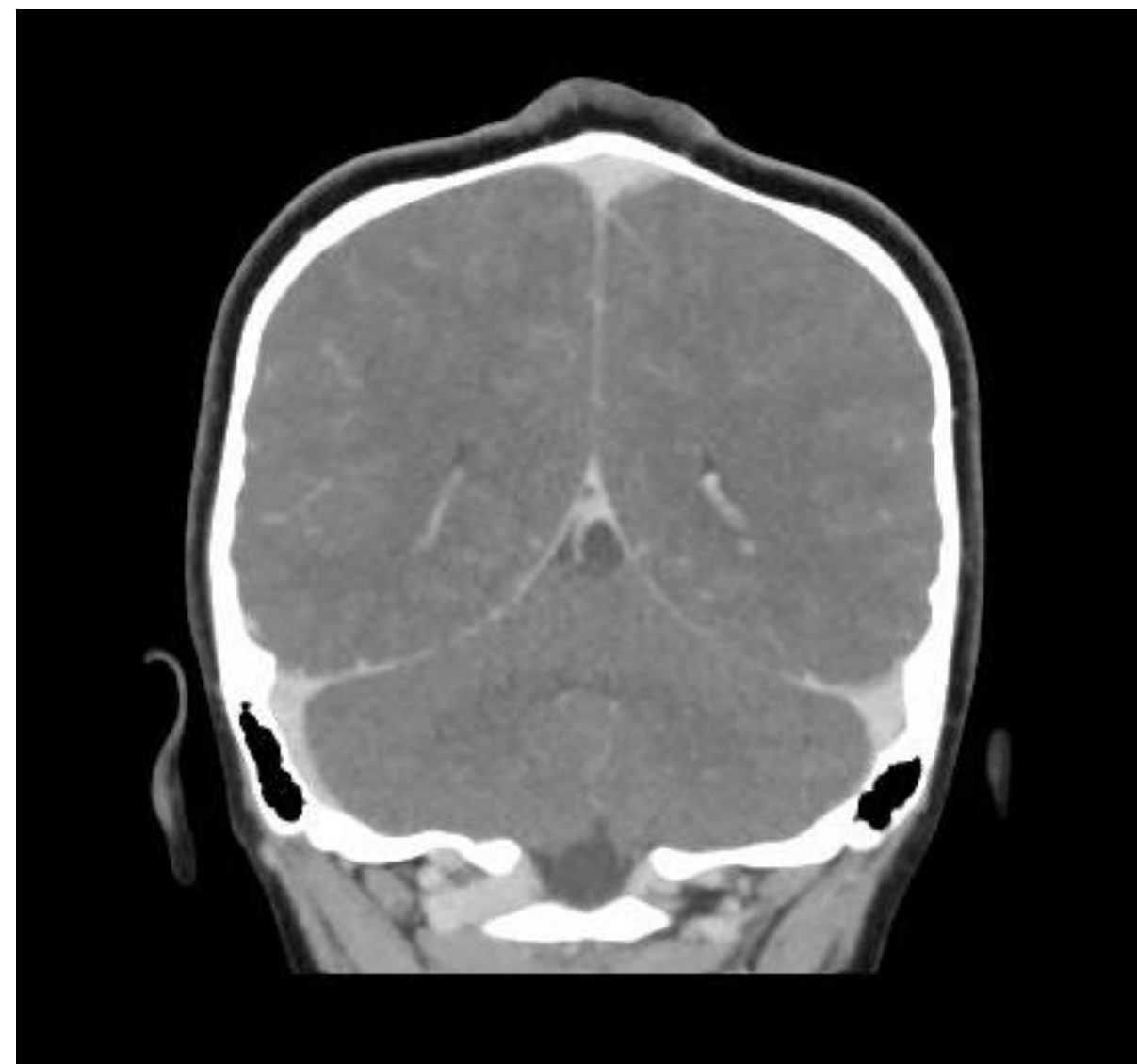


MRI of a patient with DFSP of the scalp showing calvarial changes underlying the lesion

- 10 patients required additional intervention to the skull to achieve margin clearance, with 7 requiring burring of the outer skull table, and 3 requiring full-thickness calvarial resection.
- No patients had clinical, radiographic, or pathologic evidence of intracranial extension.
- Preoperative imaging was performed in 25 patients, of which only CT was available in 5 patients, only MRI was available in 12 patients, and both CT and MRI were available in 8 patients. One patient had intraoperative imaging (CT & MRI) prior to craniectomy.

Bone Abnormalities	Periosteal Positivity		
	MRI Findings	+	-
		3 (TP)	0 (FP)
	+		
	-	12 (TN)	6 (FN)

FIGURE 3



CT of a patient with DFSP of the scalp showing moderate symmetric focal thinning of the bilateral frontal bones along the lateral extent of the lesion.

- Calvarial bone abnormalities were detected in 3 patients. 2 of these patients had CT scans on which both had positive findings and all three of the patients had MRI scans with positive findings.
- For CT scan, the sensitivity and positive predictive value of bone abnormalities detected in determining positivity of the periosteal margin were 25% and 100% respectively. The specificity and negative predictive value 100% and 50% respectively. For MRI, the sensitivity and PPV are 33% and 100% respectively, whereas the specificity and NPV were 100% and 66% respectively.

TABLE 1

	CT	MRI
Sensitivity	25%	33%
Specificity	100%	100%
PPV	100%	100%
NPV	50%	66%

Sensitivity, Specificity, Positive Predictive Value and Negative Predictive Value of CT and MRI

CONCLUSIONS

- In this case series, we examine the utility of preoperative CT and MRI imaging in predicting the positivity of the deep periosteal margin in cases of DFSP of the scalp.
- Our findings show that osseous changes seen on imaging will always correspond to presence of the tumor in the periosteum and will therefore require surgical management of the underlying bone.
- However, lack of calvarial changes does not mean that periosteum will not be found to be involved.