Fracture risk in linear morphea-affected limbs: A pilot retrospective study of adult patients

To the Editor: Linear morphea is a rare sclerosing disease of the skin and underlying tissue that commonly affects the extremities. Although skeletal complications have been reported in pediatric patients, fracture risk associated with linear morphea of the extremity (LME) has not been studied in adults.[1] We hypothesized that structural and functional impairments associated with LME may increase the localized fracture risk in LME-affected limbs. This retrospective study aimed to clarify fracture risk in LME-affected limbs relative to unaffected limbs of adult patients.

This study reviewed the medical records of adult patients with LME seen at the University of California, San Francisco and Mass General Brigham between January 2015 and December 2022 after institutional review board approval. Patients were reviewed for

Table I. Demographics and secondary outcomes* of patients with history of limb fracture

Characteristics	*N* (%)
No.	8
Sex	
Female	7 (88)
Male	1 (12)
Race	
Asian	0 (0)
Black or African American	1 (12)
Native Hawaiian or other Pacific Islander	1 (12)
White or Caucasian	6 (75)
Ethnicity	
Hispanic or Latino	2 (25)
Non-Hispanic or Latino	6 (75)
Age of disease onset, y, median [IQR]	14.5 [12.75-22.0]
Age at time of limb fracture, y, median [IQR]	36.0 [24.0-39.0]
Duration of morphea at time of fracture, years median [IQR]	12.0 [8.5-17.5]†
Personal history of systemic steroid use‡	3 (38)
Yes	3 (38)
No	4 (50)
Not specified	1 (12)
Consecutive duration of systemic steroid use in weeks, median [IQR]	4.0 [2.5-10.0]
Personal history of osteopenia§	3 (38)
Yes	3 (38)
No	4 (50)
Not specified	1 (12)
Personal history of other metabolic bone disease‖	
Yes	0 (0)
No	5 (62)
Not specified	3 (38)
Personal history of medications that alter bone metabolism¶	
Yes	0 (0)
No	6 (75)
Not specified	2 (25)
Personal history of bony vascular occlusion#	
Yes	1 (12)
No	4 (50)
Not specified	3 (38)
Functional impairments related to linear morphea	
Gait disturbance	3 (38)
Global limb atrophy	6 (75)
Joint contracture	3 (38)
Limb length discrepancy	3 (38)
Limited joint mobility	3 (38)
Fracture type**	
Atraumatic	4 (50)
Traumatic	2 (25)
Not specified	2 (25)
Limb fracture extremity	
Upper extremity	1 (12)
Lower extremity	7 (88)

*Secondary outcomes include fracture type, bone loss, functional impairment, diseases of altered bone metabolism, bony vascular occlusion, and history of systemic steroids and medications that alter bone metabolism.

†Duration of disease at time of fracture was available for 4 patients.

‡History of systemic steroid use included oral, intralesional, and intramuscular exposure.

§All 3 cases of osteopenia were identified by plain film.

‖History of other metabolic bone diseases includes osteoporosis, parathyroid disease, chronic kidney disease, and/or celiac disease.

¶History of medications that alter bone metabolism include bisphosphonates, RANK-L inhibitors, parathyroid hormone analog, selective estrogen receptor modulators (SERM), and sclerostin inhibitors.

#History of bony vascular occlusion includes history of avascular necrosis, osteonecrosis, and/or fibrosis.

**For fracture type, fractures were classified as "traumatic" or "atraumatic" based on the presence or absence of direct force or injury to the bone, respectively, as indicated from chart review.

Table II. Profiles of fracture in cases of morphea-affected limbs vs unaffected limbs

Characteristics	Morphea-affected limb fractures *N* (%)	Unaffected limb fractures *N* (%)	*P*-value
No.	6	2	
Anatomic location			>.99
Upper extremity	1 (17)	0 (0)	
Lower extremity	5 (83)	2 (100)	
Personal history of osteopenia	3 (50)	0 (0)	.46
Age at time of fracture, median [IQR], y	30.0 [22.5-39.5]	NA*	NA
Personal history of bony vascular occlusion†	1 (17)	0 (0)	>.99
Personal history of steroid use	3 (50)	0 (0)	.46
Fracture type			
Atraumatic	4 (67)‡	0 (0)	.06
Traumatic	0 (0)	2 (100)	
Not specified	2 (33)	0 (0)	

*Age at time of fracture was only available for one patient with unaffected limb fracture.
†Per chart review, this patient only received 1 month of oral steroids.
‡All cases of atraumatic fracture occurred after morphea onset.

history of limb fracture. Limbs with fracture history were categorized as cases, and the location-matched (upper or lower extremity) contralateral limb in the same patient was designated as the corresponding control. Cases and controls were then reviewed for a history of LME and secondary causes of fracture. Fisher exact testing was performed, with P values $< .05$ considered significant.

Forty-six records were reviewed, and 8 cases and 8 controls were identified (Table I). There was a higher prevalence of fracture observed in lower extremities than upper extremities (7 [88%] vs 1 [12%]) and among LME-affected limbs than unaffected limbs (6 [75%] vs 2 [25%]; $P = .13$) (Table II). Four fractures (50%) were atraumatic, 2 (25%) were traumatic, and 2 (25%) were unspecified. All atraumatic fractures involved LME-affected limbs, and all traumatic fractures involved unaffected limbs. Among 8 control limbs, 6 (75%) were unaffected and 2 (25%) were LME-affected. Additionally, osteopenia was identified in 3 cases of LME-affected lower limb fractures and avascular necrosis was observed in 1 patient with LME-affected limb fracture; there was no known osteopenia or vascular occlusion in any unaffected limbs. One DEXA scan was available, demonstrating lower bone density in the patient's LME-affected limb than the unaffected limb.

To our knowledge, this pilot retrospective study is the first to review localized fracture risk in LME-affected limbs of adult patients. Our study observed a trend toward higher prevalence of fracture in: (1) LME-affected limbs than unaffected limbs (2) lower extremities than upper extremities (Supplementary Materials, available via Mendeley at https://data.mendeley.com/datasets/bn638wxm48/1). Importantly, all atraumatic fractures, which are typically rare in premenopausal patients without secondary cause, exclusively involved LME-affected limbs.[2] Furthermore, our study observed trends of osteopenia and avascular necrosis in LME-affected limbs. These patterns of atraumatic fracture and compromised bone integrity align with the pediatric literature, including observations of spontaneous fracture and bone resorption, and bone remodeling deformities of LME-affected limbs of children.[3-5]

While the present cohort draws from 2 institutions, our sample size remained small, and associations between fracture and LME did not reach statistical significance. Additionally, the availability of bone imaging and density scans was limited. Ensuring eligible adults complete a DEXA scan may further clarify individual risk of bone loss in LME-affected limbs. Larger population studies may better define fracture risk more broadly, with the ultimate goal of identifying opportunities for early intervention.

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Conflicts of interest

Dr Haemel is a consultant to CSL Behring and an investigator for Priovant and AstraZeneca. Drs Vleugels and Shaw and Authors Kazmi, Fan, and Obiakor have no conflicts of interest to declare.

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