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RESEARCH LETTER

Inpatient Teledermatology Improves Diagnostic Accuracy and Management of Leg Ulcers in Hospitalized Patients

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Leg ulcers have been one of the most common reasons for inpatient dermatology admission and are associated with significant admission duration and cost [1]. The use of dermatology inpatient management has led to improvement in quality of life among leg ulcer patients [2]. Furthermore, with a prevalence of 1% and multifactorial causes, leg ulcer diagnosis benefits from specialist review [3]. The development of inpatient asynchronous teledermatology during the coronavirus pandemic presents a unique opportunity to optimally manage these patients while reducing healthcare costs. In fact, few studies have evaluated the impact of teledermatology on inpatient dermatologic management, especially in hospitals with no on-staff dermatologist [4]. This study evaluates diagnostic concordance and teledermatology impact on leg ulcer diagnosis, work-up, and management between referring hospitalist and inpatient teledermatology teams at University of Pittsburgh Medical Center (UPMC).

Overall, 2987 asynchronous inpatient teledermatology encounters were evaluated retrospectively between 1 July 2014, the start of our service, and 14 February 2021. Asynchronous or store-and-forward teledermatology consults were submitted by the primary team (including a physician and mid-level provider), located in 10 urban and rural hospitals (between 122 and 404 beds); as part of the consultation, teams share photos of the rash with pertinent data via the electronic medical record (EMR). The UPMC teledermatology team then evaluated and managed consultations via telephone and EMR. Pre-established leg ulcer diagnoses or repeat encounters were excluded from our evaluation, resulting in 59 patients with causes, as displayed in Fig. 1.

Table 1 includes descriptive statistics with percentage agreement to detect concordance; *p*-values were calculated using Chi-square tests of homogeneity. Most referrals (n = 35, 59.3%) used non-specific language, such as 'rash', 'ulcer', 'lesion', or 'wound', whereas 40.7% (n = 24) of referrals included specific diagnoses (e.g., 'cellulitis', 'pyoderma gangrenosum', 'vasculitis', 'abscess', or 'stasis ulcer'). Of the leg ulcer encounters, 86.4% (n = 51) had a change in diagnosis, 69.5% (n = 41) of cases had biopsy recommendation, and 96.6% (n = 57) of cases had a change in management (Table 1). The primary team and teledermatologist had the highest diagnostic concordance for the following diagnoses: one arterial ulcer, 2/10 (20%) cases of calciphylaxis, and 4/22 (18.2%) cases of venous stasis dermatitis. Of note, 42/59 (72%) patients had either in-person follow-up or biopsy confirmation of their diagnosis, while 22/59 (37.3%) had both in-person follow-up and pathologic confirmation. Notably, the biopsy recommendation among 69.1% of patients was higher than other studies

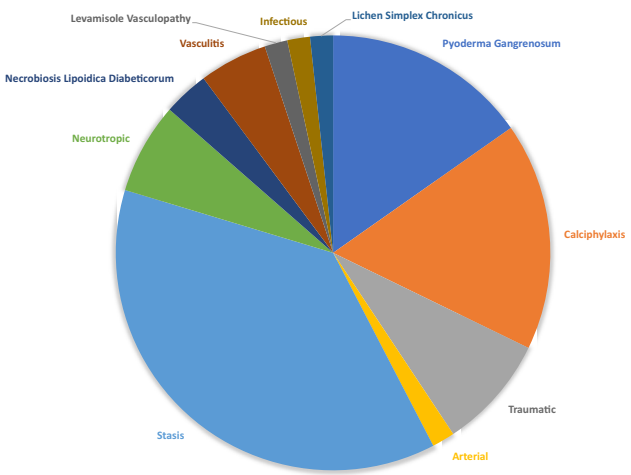

Fig. 1 Leg ulcer diagnoses among inpatient teledermatology consultations

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Table 1 Primary and teledermatology team diagnosis/management concordance

Baseline characteristics	Leg ulcer study cohort ($n = 59$)												p value
Variable	Overall	Venous stasis	Calciphylaxis	Pyoderma gangrenosum	Traumatic	Diabetic	Vasculitis	Necrobiosis lipoidica diabeticorum	Arterial	Levamisole vasculopathy	Infectious (mucor)	Lichen simplex chronicus	
	($n = 59$)	($n = 22$)	($n = 10$)	($n = 9$)	($n = 5$)	($n = 4$)	($n = 3$)	($n = 2$)	($n = 1$)	($n = 1$)	($n = 1$)	($n = 1$)	
Age, years (mean ± SD)	63.0 ± 17.4	72.5 ± 11.2	64.8 ± 17.9	61.3 ± 15.3	50.8 ± 15.2	63.0 ± 12.4	58.4 ± 20.5	50.5 ± 13.2	57.5	49.9	39.7	61.3	
Female sex (n, %)	32, 54.2%	10, 45.5%	6, 60%	5, 55.6%	3, 60%	2, 50%	1, 33.3%	2, 100%	1, 100%	1, 100%	0, 0%	1, 100%	
Discordance[a] between teledermatology and primary teams' diagnoses (n, %), [95% CI]	51, 86.4% [77.7, 95.2]	18, 81.8% [66.0, 97.7]	8, 80% [55.2, 100.0]	8, 88.9% [68.4, 100]	5, 100%	4, 100%	3, 100%	2, 100%	0, 0%	1, 100%	1, 100%	1, 100%	0.500
Biopsy recommended (n, %), [95% CI]	41, 69.5% [55.9, 79.7]	10, 45.5% [24.6, 66.3]	10, 100%	9, 100%	1, 20% [0.0, 55.1]	2, 50% [3.8, 96.2]	3, 100%	2, 100%	0, 0%	1, 100%	1, 100%	1, 100%	0.500
Systemic/topical therapy management change[b] (n, %)	57, 96.6%	21, 95.5%	10, 100%	9, 100%	5, 100%	4, 100%	3, 100%	2, 100%	1, 100%	0, 0%	1, 100%	1, 100%	

SD standard deviation, *CI* confidence interval

[a]Changes in diagnosis were defined as the lack of the final diagnosis in the primary team's differential, suspected, or concerning diagnosis

[b]Changes in therapeutic management were defined as any topical/systemic modification that was not included in the primary team's initial consultation

where dermatologists recommended biopsies in 49.6% of inpatient general ulcers seen in-person, indicating the more frequent need for pathologic confirmation in teledermatology cases [5].

In conclusion, our study suggests that leg ulcer diagnosis, work-up, and treatment are impacted by inpatient teledermatology consultation. We believe these data indicate the utility of inpatient teledermatology consultation if the service is available, and may also reflect appropriate consultation by primary teams for cases that were submitted to our teledermatology service. As prior studies have demonstrated the reliability of teledermatology in the triage of inpatient consultations, we hope these data demonstrate the clinical efficacy of this technology [6]. Limitations of this study include retrospective analysis of encounters limited to the EMR and cases in which teledermatology was requested. In addition, the primary team's differential diagnosis may be limited due to the necessity to submit quick referrals in order to optimize patient care. Lastly, we hope that this study suggests the utility of inpatient teledermatology in hospitals lacking dermatologic staff and resources while also incentivizing consultation of the specialty for a diagnosis with a broad differential. Future studies may evaluate outcomes of patients with and without teledermatology consultation and whether this has any impact on admission duration and cost savings.

Declarations

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Conflicts of interest Hasan Khosravi, Batool Nekooie, Autumn Moorhead, and Joseph C. English III have no conflicts of interest to declare.

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