Vlahovic has served as speaker and investigator for Ortho Dermatologics. Dr Gupta has served as a consultant, speaker, and investigator for Ortho Dermatologics. Dr Pillai is an employee of Bausch Health US, LLC, and may hold stock and/or stock options in its parent company. Dr Guenin is an employee of Ortho Dermatologics and may hold stock and/or stock options in its parent company. Bausch Health US, LLC is an affiliate of Bausch Health Companies Inc. Ortho Dermatologics is a division of Bausch Health US, LLC.

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REFERENCES

1. Gupta AK, Mays RR, Versteeg SG, et al. Onychomycosis in children: safety and efficacy of antifungal agents. *Pediatr Dermatol*. 2018;35(5):552-559.
2. Eichenfield LF, Friedlander SF. Pediatric onychomycosis: the emerging role of topical therapy. *J Drugs Dermatol*. 2017;16(2):105-109.
3. Elewski BE, Rich P, Pollak R, et al. Efinaconazole 10% solution in the treatment of toenail onychomycosis: two phase III multicenter, randomized, double-blind studies. *J Am Acad Dermatol*. 2013;68(4):600-608.
4. *JUBLIA (Efinaconazole) Topical Solution, 10% [package insert]*. Bridgewater, NJ: Ortho Dermatologics; 2016.
5. Rich P, Spellman M, Purohit V, et al. Tavaborole 5% topical solution for the treatment of toenail onychomycosis in pediatric patients: results from a phase 4 open-label study. *J Drugs Dermatol*. 2019;18(2):190-195.

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Variable clinical course of lichen planus following hepatitis C cure with direct-acting antivirals: A case series and literature review

To the Editor: Lichen planus (LP) is sometimes associated with hepatitis C virus (HCV).[1] No large studies have examined LP outcomes after HCV treatment with direct-acting antivirals (DAAs). Case reports and series chiefly describe oral LP (OLP) in Japan, where OLP has high prevalence and is strongly associated with HCV[2]; generalizability to other populations is unclear. Prior reports are also limited by reporting bias, describing primarily extreme outcomes (complete resolution or incident disease). To overcome these deficiencies, we performed a systematic electronic record search to identify patients with LP and DAA-treated HCV at 2 major medical centers in the United States and describe the clinical course of their LP after HCV cure.

We searched for patients with International Classification of Diseases, Ninth Revision and 10th Revision, codes for both LP and HCV at the University of California—San Francisco (UCSF), a tertiary referral academic medical center, and Zuckerberg San Francisco General Hospital (ZSFGH), an urban safety-net hospital affiliated with UCSF, and then manually reviewed cases to identify patients with successful DAA treatment of HCV, confirmed LP diagnosis, and adequate clinical description of LP outcome. We also systematically reviewed the literature for reported cases. This study was approved by the UCSF institutional review board. Methods and inclusion/exclusion criteria are available in the Supplemental Materials[3,4] (available via Mendeley at https://dx.doi.org/10.17632/wvyydpdwhp.2).

A literature search identified 6 case reports and 2 case series describing 16 patients with LP and DAA-cured HCV (Table I). Our series documents 6 additional patients (Table II). We analyzed LP distribution, LP outcome after DAA treatment of HCV (resolution, improvement, or exacerbation), and DAA received.

Of the 6 patients identified at UCSF/ZSFG, 3 (50%) had resolved LP after HCV cure, and 3 (50%) experienced persistent or worsened disease. No patients presented with purely oral LP.

Aggregate data of 22 patients from UCSF/ZSFGH and the literature review showed resolved/improved disease in 18 patients (81.8%) (resolved in 11 [50%]; improved in 7 [31.8%]) and persistent or worsened disease in 4 patients (18.1%). Of improved or resolved cases, 12 (66.7%) had oral-only disease. Cases of pure OLP were more likely to resolve ($\chi^2[1] = 5.02$; $P < .025$). Excluding 12 Japanese patients with pure OLP, the remaining 10 aggregate cases described 5 (50%) patients with improved or resolved disease and 5 (50%) with persistent relapsing/remitting or worsened disease.

Limitations of this study include the following: 1) it was a retrospective chart review, limited by

Table I. Cases from the literature of LP described in patients who underwent successful DAA treatment

Study number	Study	Patient number	Age, y	Distribution of LP	LP outcome	Last documentation of LP status after DAA	DAA medications	Covariates
1	Yoshikawa A, Terashita K, Morikawa K, et al. Interferon-free therapy with sofosbuvir plus ribavirin for successful treatment of genotype 2 hepatitis C virus with lichen planus: a case report. *Clin J Gastroenterol*. 2017;10:270-273.	1	53	Oral	Resolution	24 wk	Sofosbuvir/ ribavirin	None stated
2	Nagao Y, Nakasone K, Maeshiro T, et al. Successful treatment of oral lichen planus with direct-acting antiviral agents after liver transplantation for hepatitis C virus-associated hepatocellular carcinoma. *Case Rep Gastroenterol*. 2017;11:701-710.	1	60	Oral	Resolution	7 mo	Ledipasvir/ sofosbuvir	Immunosuppression for liver transplant initiated at same time as DAA treatment
3	Morgado-Carrasco D, Combalia A, Fustà-Novell X, et al. Aggressive erosive lichen planus associated with hepatitis C responding to sofosbuvir/ledipasvir treatment. *Indian J Dermatol Venereol Leprol*. 2019;85:326-329.	1	80s	Oral, cutaneous, genital, nail	Resolution	12 mo	Ledipasvir/ sofosbuvir	None stated
4	Nagao Y, Tsuji M. The discovery through dentistry of potentially HCV-infected Japanese patients and intervention with treatment. *Adv Res Gastroenterol Hepatol*. 2017;7(3):555711	3	74	Oral	Resolution in 1, improvement in 2	24 wk	Daclatasvir/ asunaprevir, sofosbuvir/ ribavirin, ledipasvir/ sofosbuvir	None stated

Continued

Table I. Cont'd

Study number	Study	Patient number	Age, y	Distribution of LP	LP outcome	Last documentation of LP status after DAA	DAA medications	Covariates
5	Nagao Y, Kimura K, Kawahigashi Y, et al. Successful treatment of hepatitis C virus-associated oral lichen planus by interferon-free therapy with direct-acting antivirals. Clin Translat Gastroenterol. 2016;7(7):e179.	7	74 (mean)	Oral (n = 6), cutaneous and oral (n = 1)	Resolution in 4 patients (n = 3 oral, n = 1 cutaneous and oral) Improvement in 3 patients (oral)	Up to 52 wk	Daclatasvir/ asunaprevir	Five patients were previously treated with IFN
6	Misaka K, Kishimoto T, Kawahigashi Y, et al. Use of direct-acting antivirals for the treatment of hepatitis C virus-associated oral lichen planus: a case report. *Case Rep Gastroenterol.* 2016;10:617-622.	1	60	Oral	Improvement	35 wk	Daclatasvir/ asunaprevir	None stated
7	Ansari U, Henderson LI, Stott G, et al. Treatment with ledipasvir-sofosbuvir for hepatitis C resulting in improvement of lichen planus. *JAAD Case Rep.* 2017;3:6769.	1	55	Cutaneous	Improvement followed by acute exacerbation	4 mo	Ledipasvir/ sofosbuvir	Started colchicine before exacerbation
8	Scott G, Rieger K. New-onset cutaneous lichen planus following therapy for hepatitis C with ledipasvir-sofosbuvir. *J Cutan Pathol*. 2016;43:408-409.	1	55	Oral, cutaneous, genital	Exacerbation of oral LP, new cutaneous and genital LP	3 mo	Ledipasvir/ sofosbuvir	None stated

DAA, Direct-acting antiviral; *HCV*, hepatitis C virus; *IFN*, interferon; *LP*, lichen planus.

Table II. Cases from UCSF and ZSFGH of LP described in patients who underwent successful DAA treatment

Patient number	Age (y), sex, race/ethnicity	Distribution of LP	Duration of LP before DAA initiation	LP status before DAA initiation	First documentation of LP status after DAA initiation	Last documentation of LP status after DAA completion	Final outcome of LP	DAA used	Covariates
1	63, M, white	Cutaneous, oral	5.3-y history of LP	Stable for 2 years	Complete resolution 1.3 y after DAA completion	LP in remission 3.7 y after DAA completion	Resolved	Ledispavir/sofosbuvir	None
2	77, M, white	Cutaneous, anal	2-y history of cutaneous LP 1-y history of anal LP	Exacerbation of cutaneous and anal LP 5 mo before DAA initiation	Complete resolution 5 mo after DAA initiation (2 mo after completion)	LP in remission 1.3 y after DAA completion	Resolved	Ledispavir/sofosbuvir/ribavirin	Patient took hydrochlorothiazide, amlodipine, and metoprolol before developing LP.
3	65, M, unknown	Cutaneous, genital	3.6-y history of cutaneous LP 2.4-y history of genital LP	Active cutaneous LP 2 mo before DAA initiation	Complete resolution of cutaneous LP 3 mo after DAA initiation No mention of genital LP	LP in remission 1.5 y after DAA completion	Resolved	Sofosbuvir/ribavirin	None
4	66, M, Hispanic	Cutaneous, oral	Patient treated with DAA twice because of HCV relapse: 5-mo history of LP before initial DAA course	Waxing and waning cutaneous and oral disease after both first and second treatments	Worsened oral disease 3 mo after initial DAA Improved cutaneous and oral disease 5 mo after initial DAA Cutaneous disease recurred intermittently before and after second DAA treatment	Recurrent cutaneous LP documented 11 months after second DAA treatment	Persistent relapsing-remitting disease	Sofosbuvir/velpatasvir/ribavirin	History of recurrent HCV after cure with sofosbuvir/simeprevir Patient took furosemide, propranolol and omeprazole before developing LP
5	65, M, white	Cutaneous, oral, genital	15-y history of cutaneous LP 8.4-y history of oral LP 1.8-y history of genital LP	Active 1 y 10 mo before DAA (cutaneous, genital) Oral LP last documented 8.4 y before DAA initiation	LP course during DAA treatment not documented	Worsened oral LP, persistent cutaneous LP 2.3 y after DAA completion	Persistent, worsened	Sofosbuvir/daclatasvir	None
6	70, M, white	Cutaneous	1-mo history of LP	LP onset 1 mo before DAA initiation	Exacerbated LP during DAA treatment Biopsy-confirmed diagnosis 1 mo after DAA completion	Persistent LP 3.6 y after DAA completion	Persistent-worsened	Sofosbuvir/ribavirin	Patient took lansoprazole and metformin before developing LP

DAA, Direct-acting antiviral; *HCV*, hepatitis C; *LP*, lichen planus; *M*, male; *UCSF*, University of California—San Francisco; *ZSFGH*, Zuckerberg San Francisco General Hospital.

medical record completeness and accuracy; 2) all patients were men; 3) 1 patient without histopathologically confirmed LP was included; 4) patients without a biopsy or dermatologist evaluation were excluded, possibly excluding patients less likely to be referred to a dermatology specialist; 5) the patient population had increased risk factors for HCV infection, limiting generalizability; 6) the varying natural history of LP confounded the relationship between outcome and HCV cure[1]; and 7) there were few total cases.

In sum, these limited data describe a range of responses of HCV-associated LP to serologic cure with DAA—it may resolve, improve, persist, or worsen. OLP may be more likely to resolve than cutaneous or mucocutaneous disease, although this conclusion is preliminary and severely limited by reporting and geographic biases. Prospective studies with larger cohorts are needed to better characterize LP outcomes after HCV cure.

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REFERENCES

1. Wiznia LE, Laird ME, Franks AG Jr. Hepatitis C virus and its cutaneous manifestations: treatment in the direct-acting antiviral era. *J Eur Acad Dermatol Venereol*. 2017;31(8):1260-1270.
2. Nagao Y, Tsuji M. The discovery through dentistry of potentially HCV-infected Japanese patients and intervention with treatment. *Adv Res Gastroenterol Hepatol*. 2017;7(3):555711.
3. Halevy S, Shai A. Lichenoid drug eruptions. *J Am Acad Dermatol*. 1993;29(2):249-255.
4. European Association for the Study of the Liver. EASL recommendations on treatment of hepatitis C 2018. *J Hepatol*. 2018;69(2):461-511.

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Bundled intervention to improve patient safety by reducing skin specimen–related errors in a tertiary dermatology practice

To the Editor: The preanalytic stage of the skin biopsy pathway is a common source of error resulting in wrong-site surgery, delayed diagnoses, emotional distress, and unnecessary costs.[1] Dermatologists reported that 50% of their most recent errors and 40% of their most serious errors constituted specimen errors.[2]

Few articles in the dermatology literature describe specific interventions for reducing specimen errors.[3,4] We aimed to reduce the number of skin specimen errors in our practice.

Six Sigma and Plan-Do-Study-Act (PDSA) methods were used. Root cause analysis identified miscommunication, time constraints, and software as challenges. Error rate equaled the number of errors per 1000 specimens. The average number of daily skin biopsy samples was the balancing measure. Pre- and postintervention surveys were administered. A chi-square test with continuity correction was used.

Table I provides an overview of the interventions.

- The standard operating procedure defined roles of team members during specimen collection and was displayed in patient rooms.
- Four hundred standardized anatomic sites (Supplemental Fig 1; available via Mendeley at https://doi.org/10.17632/hrd3swhyxm.1) replaced 4000 free-text site descriptors. A proprietary, institutionally designed, web-based body map denoted corresponding anatomic sites. The