Serious infections in hospitalized patients with psoriasis in the United States

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Background: Patients with psoriasis have multiple risk factors for serious infections, including immune dysregulation, systemic immunosuppressive medications, and comorbid health conditions.

Objective: We sought to determine rates and predictors of serious infections in hospitalized psoriasis patients and quantify costs of care, length of stay, and mortality.

Methods: We conducted a cross-sectional study of the Nationwide Inpatient Sample from 2002 to 2012, containing a representative 20% sample of all hospitalizations in the United States.

Results: In multivariate logistic regression models, psoriasis was associated with multiple serious infections, including methicillin-resistant *Staphylococcus aureus* (odds ratio [OR] 1.76, 95% confidence intervals [CI] 1.52-2.03), cellulitis (OR 3.21, 95% CI 3.12-3.30), herpes simplex virus infection (OR 2.21, 95% CI 1.70-2.89), infectious arthritis (OR 1.82, 95% CI 1.58-2.09), osteomyelitis (OR 1.31, 95% CI 1.18-1.46), meningitis (OR 1.31, 95% CI 1.16-1.47), encephalitis (OR 1.22, 95% CI 1.02-1.47), and tuberculosis (OR 1.34, 95% CI 1.20-1.49). Among patients with psoriasis, rates of serious infections increased over all time intervals analyzed ($P = .01$) and were significantly higher compared with those without psoriasis across all time intervals ($P < .0001$). The mean length of stay (6.6 ± 0.1 days) and cost of care ($13,291 ± $166) for psoriasis patients with serious infections was higher than that of psoriasis patients without serious infections (4.6 ± 0.03 days; $11,003 ± $96; $P < .0001$).

Limitations: The study was limited to inpatients. Medication data were not available.

Conclusion: Serious infections are increasing in incidence in US inpatients with psoriasis. (J Am Acad Dermatol 2016;75:287-96.)

Key words: biologics; cost of care; hospitalization; length of stay; methotrexate; psoriasis; serious infection.

Psoriasis is a chronic, immune-mediated, systemic inflammatory skin disorder with substantial morbidity and mortality affecting over 7 million adults in the United States.[1] Psoriasis is associated with impaired barrier function and immune dysregulation, both of the innate and adaptive immune system.[2-4] Localized and mild cases can be treated topically, although moderate to severe cases of psoriasis often require the use of systemic therapies. These therapeutics, which include conventional systemic immunosuppressants or the newer biologics, can be highly efficacious in managing psoriasis.[5,6] Although biologics should reduce inherent infectious risk by controlling the inflammatory process and subsequently reducing disease severity, these effects may be immunosuppressing and increase risk of infection in other ways. Conflicting results regarding whether these biologics

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affect the rate of serious infections in patients with psoriasis have been observed.[7,8] In addition, patients with psoriasis may have other risk factors for serious infections, including higher prevalences of diabetes mellitus, overweight, and obesity.[9] We sought to quantify the frequency and inpatient burden of serious infections in hospitalized patients with psoriasis in the United States.

CAPSULE SUMMARY

- Patients with psoriasis have multiple risk factors for serious infections, such as immune dysregulation and systemic immunosuppressants.
- Serious infections are increasing in incidence in hospitalized patients with psoriasis, with higher rates among nonwhite and nonprivately insured patients.
- Hospitalized patients with psoriasis require close monitoring for infection.

METHODS

The 2002 to 2012 Nationwide Inpatient Sample (NIS) was analyzed. The NIS is sponsored by the Healthcare Cost and Utilization Project (HCUP) of the Agency for Healthcare Research and Quality (AHRQ).[10] Each year of NIS contains an approximately 20% stratified representative sample of all hospitalizations in the United States. Sample weights were created by NIS that factored the sampling design of hospitals. These sample weights were needed to provide representative estimates of hospital discharges across the United States. All data were deidentified and no attempts were made to identify any of the individuals in the database. Patient consent was not obtained as the databases were received deidentified. All parties with access to HCUP were compliant to the HCUP formal data use agreement. The study was approved by the institutional review board at Northwestern University.

Selection of psoriasis

The databases were searched for a primary and/or secondary discharge diagnosis of psoriasis using *International Classification of Diseases, Ninth Revision, Clinical Modification* (*ICD-9-CM*) codes. The primary diagnosis was defined in NIS as the condition chiefly responsible for admission to the hospital, with up to 24 secondary diagnoses for each discharge. An *ICD-9-CM* code of 691.1 corresponds to psoriasis. *ICD-9-CM* codes for psoriasis were previously validated.[11,12] The control group included all patients without any diagnosis of psoriasis, yielding a representative cohort of hospitalized patients in the United States.

Identification of serious infections

Serious infections were selected based on those previously studied with psoriasis[8] and other infectious causes that were considered a priori with distinct *ICD-9-CM* codes for analysis. A serious infection was considered present with either a primary or secondary diagnosis of the disease. Some infections were pre-coded through the NIS Clinical Classification Software AHRQ (Rockville, MD). All variables were coded exclusively through *ICD-9-CM* codes.

Mortality

Adjusted mortality was calculated for patients with psoriasis with each type of serious infection. Mortality was adjusted for sex and race based on the US population composition according to the US Census.[13]

Data processing and statistical analysis

All data processing and statistical analyses were performed using software (SAS, Version 9.4, SAS Institute, Cary, NC). To determine the predictors of inpatient mortality in psoriasis compared with no psoriasis, weighted multivariate logistic regression models were constructed with mortality as the dependent variable. The independent variables included age (0-17, 18-39, 40-59, 60-79, ≥80 years), sex (male, female), race/ethnicity (white, black, Hispanic, Asian, Native American, multiracial/other), median annual income of the hospital ZIP code (quartiles), health insurance coverage (Medicare, Medicaid, private, self-pay, no charge, other) number of chronic conditions (0-1, 2-5, ≥6), season of admission (winter, spring, summer, autumn), hospital location (metropolitan ≥1 million, fringe/metropolitan <1 million, micropolitan, not metropolitan or micropolitan; Northeast, Midwest, South, and West), teaching status (yes, no), bed size (small, medium, large), and the full panel of serious infections. Independent variables were chosen to assess for sociodemographic disparities, as disparities in hospitalization rates and mortality have been observed in other dermatologic disorders, such as pemphigus.[14] Micropolitan counties were defined as an urban cluster population between 10,000 and 49,999 people.[15] A chronic condition was defined as a condition lasting at least 12 months and meeting at least 1 of the following criteria: it places limitations on self-care or requires continuous treatment/therapy. Multivariate logistic regression models used stepwise selection from the above-mentioned covariates (alpha = 0.1). Complete case