Analysis of Errors in the Management of Cutaneous Disorders

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PRACTICE **POINTS**

- Errors in the management of cutaneous disorders predominantly are due to misdiagnosis rather than treatment oversights.
- There is a tendency among medical providers to incorrectly diagnose dermatoses as infectious disorders and to miss the diagnosis of inflammatory dermatoses.
- A similar pattern of errors occurs for patients' interpretations of their own skin conditions.
- Use of available rapid bedside diagnostic techniques can reduce the likelihood of errors made by medical providers.

In this study, we prospectively and retrospectively evaluated the occurrence of errors in the management of cutaneous disorders from patient visits and medical records in a single dermatology practice in southeast Virginia over a 3-year period (June 2020–July 2023). Providers should be able to improve diagnostic accuracy by utilizing established rapid bedside diagnostic techniques.

Humans are inherently prone to errors. The extent and consequences of medical errors were documented in the 2000 publication of *To Err is Human: Building a Safer Health System*.[1] Published research on medical errors in dermatology has emphasized the heuristic issues involved in diagnosis,[2-6] essentially approaching the "why?" and "how?" of such errors. By contrast, the current study aimed to elucidate the "what?"—what are the dermatologic conditions most prone to diagnostic and/or management errors? One study published in 1987 approached this question by analyzing patterns of errors for dermatologic conditions in patients referred for specialty care by primary care physicians.[7] The current study aimed to update and expand on the findings of this 1987 report by comparing more recent data on the errors made by providers and patients regarding skin conditions.

Methods

Data were collected prospectively from March 18, 2021, through July 25, 2023. Prospective data were obtained by recording the nature of errors noted for all patients seen by a board-certified dermatologist (R.J.P.) during routine outpatient practice in Norfolk, Virginia. This practice is limited to medical dermatology and accepts patients of any age from any referral source, with or without medical insurance. Retrospective data were obtained by review of electronic medical records for all patients seen by the same board-certified dermatologist from June 5, 2020, through March 12, 2021, who previously had been seen by an outside provider or were self-referred. In this study, the term *diagnosis* is used to describe providers' explicit or imputed conclusions as to the nature of a dermatosis, and the term *interpretation* is used to describe patients' conclusions about their own condition. For this study, the patients' self-made interpretations of their dermatoses were deemed to be correct when they agreed with those made by the dermatologist using standard clinicopathologic criteria supplemented by rapid bedside diagnostic techniques, as detailed in the 1987 study.[7]

Cases in which diagnostic or therapeutic errors were noted were entered into a spreadsheet that excluded patients' names or other identifiers. For each noted case of diagnostic or therapeutic error, the following data were

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entered: patient's age and sex; the name of the incorrect diagnosis, interpretation, or treatment; and the name of the correct (missed) diagnosis, along with the source of the error (provider or patient). Provider diagnoses were determined from medical records or patient statements or were imputed from the generally accepted indications for prescribed treatments. A provider was deemed to be any practitioner with prescriptive authority. Patients' interpretations of their conditions were determined by patient statements or were imputed based on the indications for treatments being used. A treatment error was recorded when a diagnosis or interpretation was deemed to be correct, but treatment was deemed to be inappropriate. The same dermatologist (R.J.P) made all determinations as to the nature of the errors and their source.

Diagnostic errors were determined in several situations: (1) if the interpretation made by the patient of their dermatosis differed from the correct diagnosis in the absence of any additional diagnostic documentation, the correct diagnosis was scored as a missed diagnosis and the incorrect interpretation was scored as such; (2) if the provider's diagnosis in the patient's medical record differed from the correct diagnosis, both the correct (missed) and incorrect diagnoses were recorded; and (3) if the indication(s) of the medication(s) prescribed by the provider or used by the patient for their condition differed from the correct diagnosis, an imputed diagnosis based on this indication was scored as the incorrect diagnosis and the correct (missed) diagnosis was recorded; for example, an error would be entered into the spreadsheet for a patient using terbinafine cream for what was actually psoriasis. For a medication with multiple active agents, an error would be entered into the spreadsheet only if none of its indications matched the correct diagnosis; for example, if the patient had been prescribed a betamethasone/clotrimazole product, no error would be scored if the correct diagnosis was a steroid-responsive dermatosis, dermatophytosis, candidiasis, or tinea versicolor. For a single medication with multiple indications, no error would be recorded if the correct diagnosis was any of these indications; for example, in a patient who had been prescribed topical ketoconazole, no error would be scored if the correct diagnosis was dermatophytosis, candidiasis, tinea versicolor, or seborrheic dermatitis. Additionally, no error would be recorded if the correct diagnosis was uncertain at the time of initial patient evaluation or during chart review.

Standard spreadsheet functions and the pandas package[8] from the Python programming language[9] were used to extract relevant data from the spreadsheet (Tables 1-4).

TABLE 1. Rank Order of Combined Incorrect Provider Diagnoses and Incorrect Patient Interpretations (N=434)[a]

Diagnosis/Interpretation	No. of cases
Dermatophytosis	124
Bacterial pyoderma	82
Dermatitis, not otherwise specified	69
Candidiasis	32
Scabies	28
Herpes simplex	14
Herpes zoster	12
Psoriasis	12
Cellulitis	9
Wart	8
Seborrheic dermatitis	6
Insect bite	5
Contact dermatitis	4
Acne vulgaris	4
Tinea versicolor	4
Actinic keratosis	3
Rosacea	3
Folliculitis	3
Nummular dermatitis	2
Atopic dermatitis	2
Drug eruption	2
Pityriasis rosea	2
Pediculosis	2
Molluscum contagiosum	2

[a]Unique case errors excluded.

Results

A total of 446 patient visits (182 males, 264 females) were included in the study, in which a total of 486 errors were found in the combined prospective and retrospective portions of the study. These errors involved 1.4% of all patient visits for the study period—specifically, all patients seen prospectively by the dermatologist (R.J.P.) in routine practice as well as all patient records retrospectively reviewed. The age of the patients ranged from 4 to 95 years; the mean age was 51.5 years for males and 50.8 years for females.

The study results are outlined in Tables 1 through 4. To minimize the amount of data provided with no appreciable effect on the results, cases in which an incorrect or missed diagnosis/interpretation occurred only once (ie, unique case errors) were excluded from the tables.

TABLE 2. Rank Order of Diagnoses Missed by Providers and Patients (N=413)

Diagnosis	No. of cases	Diagnosis	No. of cases
Dermatitis, not otherwise specified	67	Lupus erythematosus	4
Dermatophytosis	50	Scabies	4
Contact dermatitis	40	Molluscum contagiosum	4
Nummular dermatitis	30	Insect bite	3
Psoriasis	30	Grover disease	3
Rosacea	17	Lichen planus	3
Seborrheic dermatitis	16	Vitiligo	3
Folliculitis	12	Squamous cell carcinoma	3
Pityriasis rosea	11	Intertrigo	3
Stasis dermatitis	8	Scarring alopecia	3
Tinea versicolor	8	Parasitic infestation	3
Lichen simplex	7	Seborrheic keratosis	3
Granuloma annulare	7	Lichen sclerosus	2
Actinic keratosis	6	Annular erythema	2
Atopic dermatitis	6	Porokeratosis	2
Delusional parasitosis	5	Pityriasis alba	2
Bacterial pyoderma	5	Furunculosis	2
Perioral dermatitis	5	Urticaria	2
Basal cell carcinoma	4	Sarcoidosis	2
Wart	4	Syphilis	2
Drug eruption	4	Acne vulgaris	2
Nail dystrophy	4	Pyogenic granuloma	2
Herpes simplex	4	Perleche	2
		Scrotal dermatitis	2

[a]Unique cases excluded.

Tables 1 and 2 indicate the numbers and types of incorrect and missed diagnoses.

In the combined patient and provider cases, there were 434 instances in which provider diagnoses and patient interpretations were incorrect, 320 (73.7%) of which involved infectious disorders. By contrast, of the 413 instances of provider and patient missed diagnoses 289 (70.0%) were inflammatory dermatoses. The pattern was similar for patients' incorrect interpretations compared to the incorrect diagnoses of the medical providers. Patients incorrectly interpreted their dermatoses as infectious in 79.5% (101/127) of cases. Similarly, providers incorrectly diagnosed their patients' dermatoses as infectious in 75.4% (211/280) of cases (Table 3). For patients' missed diagnoses, 70.7% (82/116) involved inflammatory dermatoses. For providers' missed diagnoses, 63.9% (179/280) involved inflammatory dermatoses (Table 4).

TABLE 3. Comparison of Incorrect Patient Interpretations vs Incorrect Provider Diagnoses

Incorrect patient interpretations vs provider diagnoses	No. of cases
Incorrect patient interpretations (n=127)[a]	
Bacterial pyoderma	43
Dermatophytosis	42
Dermatitis, not otherwise specified	17
Psoriasis	5
Candidiasis	4
Insect bite	4
Acne vulgaris	3
Wart	3
Herpes simplex	2
Tinea versicolor	2
Scabies	2
Incorrect provider diagnoses (n=280)[a]	
Dermatophytosis	77
Dermatitis, not otherwise specified	48
Bacterial pyoderma	37
Candidiasis	28
Scabies	26
Herpes simplex	12
Herpes zoster	11
Cellulitis	9
Psoriasis	7
Seborrheic dermatitis	5
Wart	4
Folliculitis	3
Contact dermatitis	3
Pityriasis rosea	2
Rosacea	2
Nummular dermatitis	2
Pediculosis	2
Tinea versicolor	2

[a]Unique case errors excluded.

Treatment errors in the context of correct diagnoses were uncommon. Fifteen (3.4%) such cases were noted in the 446 error-containing patient visits. In 4 (26.7%) of the 15 cases, potent topical corticosteroids were used long term on inappropriate cutaneous sites (eg, genital, facial, or intertriginous areas). Another 4 (26.7%) cases involved fungal infections: nystatin used for tinea versicolor in 1 case and for dermatophytosis in another, widespread dermatophytosis treated topically, and use of a nonindicated topical antifungal for onychomycosis. Other examples involved inadequate dosing of systemic corticosteroids for extensive acute contact dermatitis, psoriasis treated with systemic corticosteroids, inadequate dosing of medication for seborrheic dermatitis, and treatment with valacyclovir based solely on serologic testing.

Comment

The results of our study indicate that errors in management of cutaneous disorders are overwhelmingly diagnostic in nature, while treatment errors appear to be unusual when the correct diagnosis is made. Both the current study and the 1987 study indicated a notable tendency of providers to incorrectly diagnose infectious disorders and to miss the diagnosis of inflammatory dermatoses.[7] The current study extends this finding to include patients' interpretive errors.

It is notable that many of the incorrect and missed diagnoses can be confirmed or ruled out by rapid bedside techniques, namely potassium hydroxide (KOH) preparation for dermatophytes, candidiasis, and tinea versicolor; wet preparation for scabies and pediculosis; Tzanck preparation for herpes simplex and herpes zoster; and crush preparation for molluscum contagiosum. Notably, 57.8% (281/486) of cases in which error was noted involved disorders for which the use of one of these bedside diagnostic tests could have correctly established a diagnosis or ruled out an incorrect one; thus in an ideal world in which these tests were performed perfectly in all appropriate cases, more than half of the errors detected in this study could have been avoided. Dermatophytosis was involved in 35.8% (174/486) of the error-containing patient encounters in this study; therefore, if only the KOH preparation is considered, more than one-third of all errors documented in this study could have been avoided. Unfortunately, surveys have suggested that among dermatologists in the United States and some other countries, KOH preparations are used infrequently.[10-12]

Certain limitations were inherent to this study. The data were derived from a single dermatology practice by one physician in one geographic region over a short period of time. These factors may limit the generalizability of the results. Although the goal was to identify all errors made for the patients seen, some errors likely were missed due to incomplete patient history or inaccurate medication listings. There is no absolute way to determine if the diagnoses or the treatments deemed correct by the dermatologist were, in fact, correct. For cases in which a patient's interpretation or a provider's diagnosis was imputed from the indication(s) associated with the medication(s) being

TABLE 4. Comparison of Diagnoses Missed by Patient vs Medical Provider

Diagnosis	No. of cases
Patient missed diagnosis (n=116)[a]	
Dermatitis, not otherwise specified	27
Contact dermatitis	9
Nummular dermatitis	7
Lichen simplex	6
Psoriasis	5
Seborrheic dermatitis	5
Rosacea	4
Actinic keratosis	4
Tinea versicolor	4
Nail dystrophy	4
Pityriasis rosea	4
Intertrigo	3
Dermatophytosis	3
Folliculitis	3
Scabies	3
Bacterial pyoderma	3
Squamous cell carcinoma	3
Delusional parasitosis	3
Drug eruption	2
Granuloma annulare	2
Herpes simplex	2
Acne keloidalis	2
Seborrheic keratosis	2
Pyogenic granuloma	2
Atopic dermatitis	2
Perleche	2
Provider missed diagnosis (n=280)[a]	
Dermatophytosis	45
Dermatitis, not otherwise specified	37
Contact dermatitis	31
Nummular dermatitis	23
Psoriasis	23

Diagnosis	No. of cases
Provider missed diagnosis (n=280)[a] (continued)	
Rosacea	12
Seborrheic dermatitis	11
Folliculitis	9
Stasis dermatitis	7
Pityriasis rosea	6
Granuloma annulare	5
Molluscum contagiosum	4
Lupus erythematosus	4
Porokeratosis	4
Candidiasis	4
Excoriations	4
Tinea versicolor	4
Atopic dermatitis	4
Confluent and reticulated papillomatosis	3
Parasitic infection	3
Wart	3
Lichen planus	3
Grover disease	3
Delusional parasitosis	2
Actinic keratosis	2
Herpes simplex	2
Drug eruption	2
Scarring alopecia	2
Bacterial pyoderma	2
Basal cell carcinoma	2
Porokeratosis	2
Urticaria	2
Syphilis	2
Lichen sclerosus	2
Annular erythema	2
Insect bite	2
Vitiligo	2

[a]Unique case errors excluded.

used, one cannot exclude the possibility that a medication was used appropriately for a nonlabeled or nonstandard indication. The designation of treatment errors may be subject to different interpretations by different clinicians. Despite these limitations, it is likely that the results of this study can be extrapolated to reasonably similar dermatology practices. The apparently persistent and consistent tendency of clinicians to incorrectly diagnose infectious dermatoses and to miss inflammatory conditions has implications for teaching of medical dermatology in the academic and clinical settings. In particular, given that dermatophytosis is the diagnosis involved in the highest number of errors, special emphasis should be placed on this infection in clinician education.

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