Inpatient Dermatology

Misha Rosenbach
Karolyn A. Wanat
Robert G. Micheletti
Editors

Laura A. Taylor
Associate Editor

Springer

Inpatient Dermatology

Misha Rosenbach • Karolyn A. Wanat
Robert G. Micheletti
Editors

Laura A. Taylor
Associate Editor

Inpatient Dermatology

Springer

Editors
Misha Rosenbach, MD
Department of Dermatology
Perelman School of Medicine
University of Pennsylvania
Philadelphia, PA
USA

Karolyn A. Wanat, MD
Department of Dermatology
Medical College of Wisconsin
Milwaukee, WI
USA

Robert G. Micheletti, MD
Department of Dermatology
Perelman School of Medicine
University of Pennsylvania
Philadelphia, PA
USA

Associate Editor
Laura A. Taylor, MD
Department of Pathology and Laboratory Medicine
University of Pennsylvania
Philadelphia, PA
USA

ISBN 978-3-319-18448-7 ISBN 978-3-319-18449-4 (eBook)
https://doi.org/10.1007/978-3-319-18449-4

Library of Congress Control Number: 2018941849

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

We would like to thank our many mentors and colleagues, not just in dermatology, but across medicine. The emerging field of inpatient hospital-based dermatology is rapidly growing, often attracting the best and brightest dermatology residents and young physicians. Care of inpatients requires intelligence, curiosity, and interdisciplinary care and communication. We are all always learning from our patients, our students, and our colleagues who consult us. In particular, we have been fortunate to train at an institution where there is close collaboration between internal medicine and dermatology, and we have countless friends, mentors, and colleagues who have contributed to the care of our challenging inpatient dermatology patients, teaching us invaluable tips, tricks, and pearls along the way. We are delighted to share our approach and an up-to-date, evidence-based, and expert opinion-supplemented guide to inpatient dermatology.

In particular, we would like to thank Dr. William James, who is the pinnacle of dermatologic knowledge and a tireless teacher and generous mentor. He has served as a role model and inspiration for all of us, and we would not be where we are without him. Additionally, we are fortunate to have trained just as the hospitalist movement was starting in dermatology. Dr. Lindy Fox helped spark the field of inpatient dermatology, with inspiration from her mentor and legendary clinician, Dr. Marc Grossman, whose career as an inpatient dermatologist helped demonstrate that this career path was possible. Both editors Drs. Rosenbach and Micheletti rotated with Dr. Fox as residents and feel she is the trailblazer of our generation who has launched the entire field of inpatient dermatology; without her, we

would not know what we know or do what we do, and we are forever grateful for her mentorship and example. We would like to thank the rest of the other founders of the inpatient dermatology society, Dr. Kanade Shinkai, Dr. Jonathan Cotliar, Dr. Lauren Hughey, and Dr. Daniela Kroshinsky, and the rest of the Society of Dermatology Hospitalists, a close-knit group of like-minded dermatologists who, like us, have chosen to focus their careers on the care and management of hospitalized patients and their dermatologic problems. We also must thank our collaborators in dermatopathology, in particular Drs. Rosalie Elenitsas, David Elder, George Xu, Mary Stone, Vincent Liu, and Brian Swick, without whom we would be unable to confirm many of these challenging diagnoses. Finally, we would like to dedicate this book to our patients, from whom and for whom we are always learning. Thank you for reading.

Dr. Rosenbach would like to dedicate this book to his family, who are endlessly loving and supportive and who never complain that he keeps an unpredictable schedule determined entirely by the number of consults in a given day. His wife, Anna, and children, Lara and Jake, are his loving family and his greatest joy. He thanks all of them for being so patient and understanding and is sorry for the many weekends spent working on this; he thinks they are the absolute best, and they make him thankful each and every day. Dr. Rosenbach would also like to thank his co-editors, who have put up with him for years in all sorts of ways and are the best colleagues one could ask for.

Dr. Wanat would like to dedicate this book to her always supportive, upbeat, and large Wanat family and her incredible husband, Steven, who is unwavering in his support, love, calming presence, and balance. In addition, she feels eternally grateful to her dermatology colleagues including the co-editors for being great to work with, authors of the book who worked so hard on their chapters, near and far mentors for always being there, her co-residents for being the absolute best, and all the residents and patients she has already had the chance to work with—her passion for dermatology is fueled by their presence.

Dr. Micheletti would like to dedicate this book to his wife, Dorothy; son, Andrew; and daughter, Elisa, by whom he is inspired daily and of whom he is endlessly proud. He would also like to thank his mother

and father, a dermatologist, for setting him on this path, as well as the countless medical school and residency mentors, students, residents, colleagues, and patients who have helped sustain him along the way. The practice of medicine is an incredible privilege, and the work of a dermatology hospitalist is never boring. May we all continue to learn and strive together daily for the benefit of our patients.

Dr. Taylor would like to dedicate this book to her incredible family and friends. She would like to specifically thank her father who instilled in her a love of learning, travel, and medicine and her mother who taught her to dream big and work hard. She would like to thank Dr. Leeman who is largely responsible for her enthusiasm for and dedication to academic research and to Dr. Louis DePalma for inspiring her to become a pathologist. She would like to thank Drs. Elder, Rosenbach, and Elenitsas for their invaluable support and mentorship and for providing models for the type of clinician she hopes to become. She feels that it has been a fantastic privilege to work on this book alongside such knowledgeable and inspiring colleagues.

Preface

Welcome to inpatient dermatology!

This book aims to fill a novel space in dermatology education: the recognition and appropriate initial management of key dermatologic diseases you will encounter in the inpatient setting. Inpatient dermatology is an exciting, dynamic, and challenging field that may seem overwhelming in the beginning. We hope that this book will help provide the reader with a practical initial approach to the complex patient.

Dermatology is unique in that its organ of study is visible to the naked eye, often providing clues to the etiology of systemic diseases (including autoimmune, infectious, and neoplastic conditions) that otherwise span a variety of disciplines. Therefore, an informed assessment of the skin is an invaluable component of the inpatient workup. As such, this textbook is not geared solely toward dermatologists but also may be used as a resource for anyone who cares for patients in the hospital setting. By providing essential information in a concise, usable package, we hope to provide a systematic approach for evaluating inpatients with cutaneous pathology.

We have attempted to provide concise, bulleted, easy-to-read-and-reference, key material to help physicians diagnose and differentiate the dermatologic diseases that occur in the inpatient setting. Each brief chapter is focused on one specific inpatient dermatologic condition, with carefully curated clinical photographs and corresponding histopathologic images to aid readers in developing clinical-pathologic correlation and pattern recognition for these entities. We have provided a list of essential differential diagnoses which are important to consider and a day-one, initial workup and management plan for each condition. The sections are preceded by diagnostic pearls from the editors, where we share our approach to these often-challenging conditions.

The literature underscores the importance of inpatient dermatology consults by demonstrating that skin findings are often overlooked by non-dermatologists in hospitalized patients, with over three quarters of patients' relevant skin findings not noted by the primary team. One study demonstrated that when dermatologists consult on hospitalized patients, the diagnosis and/or treatment is changed 60% of the time. Other works have demonstrated that involving a dermatologist in the evaluation of common diagnoses such as cellulitis can reduce misdiagnoses (as one large study demonstrated, 75% of cases of "cellulitis" may instead represent pseudocellulitis, stasis dermatitis, contact dermatitis, Lyme, and other entities). Therefore, it is paramount that physicians, regardless of their specialization, are attentive to cutaneous findings so they can request the appropriate consultation or provide the appropriate review.

In this era of cost-conscious care and penalties for readmission, it is important dermatologists are able to identify and mitigate some of the cutaneous risk factors for cellulitis, so that they can guide management and reduce recurrent disease and readmissions. A study in England demonstrated that involving dermatologists in the diagnosis and management of lower limb cellulitis led to alternate diagnoses in 1/3 of cases and dramatically reduced the need for inpatient admission. Finally, emerging data suggest that simply having timely access to inpatient dermatologists can lead to reduced mortality and improved overall survival in patients presenting with Stevens-Johnson syndrome/toxic epidermal necrolysis.

This book is not a comprehensive textbook covering the breadth of dermatology; our focus is to guide point-of-care physicians as they are confronted with skin problems in hospitalized patients. The initial workup that we present is detailed and designed to help clinicians narrow their differential and hone in on a specific diagnosis and treatment plan. Our suggested evaluation is not exhaustive—what we have laid out should help clinicians make the vast majority of correct diagnoses and exclude alternate possibilities in a prompt and economical manner.

As with any text, the pages herein may quickly become outdated as the practice of medicine evolves. Inpatient medicine in particular is a rapidly changing environment: Patients present with novel acute illnesses, new pathogens and patterns of antibiotic resistance emerge, and cutaneous side effects result from clinical trial drugs and cutting-edge chemotherapeutic regimens. When evaluating inpatients, it is always worthwhile to consider searching the primary medical literature. The contents of these pages are designed to give a structured, algorithmic framework for evaluating inpatients, but should not be used in isolation to decide on treatment plans. Instead, each individual patient and case represent a unique combination of comorbidities and problems, requiring a tailored approach.

The practice of inpatient dermatology is humbling, and in many cases a specific final diagnosis is elusive. The approach we advocate is to cast a wide net, considering a broad array of differential diagnoses, and then to supplement the patient's history and clinical exam with a focus on the specific cutaneous morphology, using appropriate diagnostic tests to narrow in on a more focused differential or specific diagnosis. This textbook is designed to help guide that process, with a mind toward cost-conscious care and avoiding unnecessary, extraneous laboratory evaluations whenever possible. We hope readers find the format and content helpful as they care for these challenging conditions and help improve the health and lives of inpatients suffering from skin disease or cutaneous manifestations of systemic illness or treatments.

We hope you find this text helpful in your evaluation and management of inpatients with dermatological issues!

Misha Rosenbach, MD
Karolyn A. Wanat, MD
Robert G. Micheletti, MD
Laura A. Taylor, MD

References

Nahass GT, Meyer AJ, Campbell SF, Heaney RM. Prevalence of cutaneous findings in hospitalized medical patients. J Am Acad Dermatol. 1995;33:207–2011.

Falanga V, Schachner LA, Rae V, et al. Dermatologic consultations in the hospital setting. Arch Dermatol. 1994;130:1022–25.

Hughey LC. Why perform inpatient consultations. Dermatol Ther. 2011;24:149–50.

Strazzula L, Cotliar J, Fox LP, Hughey L, Shinkai K, Gee SN, Kroshinsky D. Inpatient dermatology consultation aids diagnosis of cellulitis among hospitalized patients: a multi-institutional analysis. J Am Acad Dermatol. 2015;73:70–5.

Kroshinsky D, Cotliar J, Hughey LC, Shinkai K, Fox LP. Association of dermatology consultation with accuracy of cutaneous disorder diagnoses in hospitalized patients. JAMA Dermatol. 2016;152(4):477–80.

Levell NJ, Wingfield CG, Garioch JJ. Severe lower limb cellulitis is best diagnosed by dermatologists and managed with shared care between primary and secondary care. Br J Dermatol. 2011;164:1326–8.

Micheletti R. The United States Dermatology Hospitalist Experience with Stevens-Johnson syndrome/toxic epidermal necrolysis: a multicenter retrospective study of 405 patients. Medical Dermatology Society Abstract Session, 2016, Washington, DC.

Contents

Part IX Erythroderma

Part X Inflammatory and Autoimmune Conditions

Contributors

Jack Abbott, MD Department of Dermatopathology, University of Pennsylvania, Philadelphia, PA, USA

Katherine K. Brown, MD Department of Dermatology, University of Pennsylvania, Philadelphia, PA, USA

Aileen Y. Chang, MD Department of Dermatology, University of California, San Francisco, CA, USA

Pooja Chitgopeker, MD University of Iowa, Iowa City, IA, USA

Juliana K. Choi, MD Department of Dermatology, University of Pennsylvania, Philadelphia, PA, USA

Department of Dermatology, Veteran Affairs Medical Center, Philadelphia, PA, USA

Nkanyezi N. Ferguson, MD University of Iowa Hospital and Clinics, Iowa City, IA, USA

Amy K. Forrestel, MD Department of Dermatology, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA, USA

Grant Ghahramani, MD Cotton O'Neil Dermatology, Topeka, KS, USA

Rachel Klein, MD Accent Dermatology, Medford, NJ, USA

Reid W. Masters, MD Department of Dermatology, Virginia Mason Medical Center, Seattle, WA, USA

Robert G. Micheletti, MD Department of Dermatology, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA, USA

Badri Modi, MD Division of Dermatology, City of Hope, Duarte, CA, USA

Molly Moye, MD Forefront Dermatology, Louisville, KY, USA

Krishna A. Mutgi, MD Mercy Health Dermatology, Toledo, OH, USA

Megan H. Noe, MD, MPH Department of Dermatology, University of Pennsylvania, Philadelphia, PA, USA

Lauren Orenstein, MD, FAAD Department of Dermatology, Temple University, Philadelphia, PA, USA

Lisa Pappas-Taffer, MD Department of Dermatology, University of Pennsylvania, Philadelphia, PA, USA

Evan Piette, MD University of Pennsylvania, Philadelphia, PA, USA

Douglas J. Pugliese, MD Department of Dermatology, Penn Presbyterian Medical Center, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA, USA

Misha Rosenbach, MD Department of Dermatology, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA, USA

Sara Samimi, MD Department of Dermatology, University of Pennsylvania, Philadelphia, PA, USA

Inbal Sander, MD Johns Hopkins School of Medicine, Baltimore, MD, USA

John C. Selby, MD, PhD University of Iowa Hospitals and Clinics, Iowa City, IA, USA

Natalie Spaccarelli, MD University of Pennsylvania, Philadelphia, PA, USA

Katherine T. Steele, MD Department of Dermatology, Perelman School of Medicine at the University of Pennsylvania, Philadelphia, PA, USA

Sasha Stephen, MD Department of Dermatology, Perelman School of Medicine at the University of Pennsylvania, Philadelphia, PA, USA

Campbell L. Stewart, MD Division of Dermatology, Department of Medicine, University of Washington, Seattle, WA, USA

Laura A. Taylor, MD Department of Pathology and Laboratory Medicine, University of Pennsylvania, Philadelphia, PA, USA

Amanda J. Tschetter, MD University of Minnesota Health, Minneapolis, MN, USA

Elizabeth A. Vanderah, MD Mercy Clinic, Washington, MO, USA

Nahid Y. Vidal, MD Dartmouth-Hitchcock Medical Center, Department of Surgery, Section of Dermatology, Geisel School of Medicine, Hanover, NH, USA

Joy Wan, MD Children's Hospital of Philadelphia, University of Pennsylvania, Philadelphia, PA, USA

Karolyn A. Wanat, MD Department of Dermatology, Medical College of Wisconsin, Milwaukee, WI, USA

Natalie Wright, MD Department of Dermatology, Brigham and Women's Hospital, Harvard University, Boston, MA, USA

Part I

Introduction

General Principles and Approach to Inpatient Dermatology

1

Misha Rosenbach

Introduction

Inpatient dermatology comprises a challenging subset of dermatologic care. As criteria for hospitalization have become more stringent, the inpatient population has become more complex, often requiring interdisciplinary care to manage patients' multiple comorbid problems. The dermatologist plays a crucial role, as many systemic diseases with high morbidity and mortality—from infections to autoimmune diseases to cancer to adverse drug reactions—can primarily present in the skin or involve the skin in isolation. Much of patient disease management, dermatologic and otherwise, has shifted to the outpatient setting, making inpatient treatment highly focused on acute disease management. The dermatologist is often consulted to determine if a patient's cutaneous lesions represent clues to an underlying illness necessitating inpatient treatment, or if the acuity of the lesion itself is such that the patient should be admitted or have their hospital stay prolonged. As most physicians receive only minimal exposure to dermatology in their training and due to the highly variable presentations of cutaneous disease, the dermatologist's insight, guidance, and education in this area can greatly improve patient care.

This text is focused on the initial diagnosis and management of cutaneous findings seen during the practice of inpatient medicine, from the emergency room, through the wards, up to the intensive care unit. In this book we emphasize clinical/pathologic correlation, as inpatients are often acutely ill, and it is important to zero in on a precise diagnosis and rule out alternative explanations as quickly as possible. Doing so often requires a thorough history, detailed cutaneous examination, and frequently a skin biopsy to identify diagnostic features of a particular dis ease.

In order to accurately diagnose and manage skin diseases, a basic framework of dermatologic nomenclature is essential. These terms help to guide the physician during the initial evaluation of the patient, and when interfacing with the descriptions laid out in this text, or during conversations with colleagues across specialties. Most skin findings can be broken down into a description of the primary lesion's most prominent morphology, the color of the lesions, secondary characteristics of the eruption, and distribution. While a comprehensive discussion of which differential diagnoses fall under each morphologic type is beyond the scope of this book, a general framework is essential when discussing inpatients' skin eruptions.

M. Rosenbach, MD
Department of Dermatology, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA, USA
e-mail: Misha.Rosenbach@uphs.upenn.edu

M. Rosenbach et al. (eds.), *Inpatient Dermatology*,
https://doi.org/10.1007/978-3-319-18449-4_1

Primary Morphologies

Primary morphologic descriptions allow lesions to be broadly characterized based on size, palpability, and contents.

Flat, nonpalpable lesions:	
Macule	Small (<1 cm), flat, non-palpable
Patches	Broad (>1 cm) flat lesions
Raised, solid, palpable lesions:	
Papules	Small (<1 cm) palpable "bumps"
Plaques	Broad (>1 cm) elevated lesions, like a raised patch, or "plateau"
Nodules	Large firm lesions bigger than typical papules; may be subcutaneous, dermal-based, or superficial
Tumors	Infiltrative masses; may be endophytic or exophytic
Raised, fluid filled lesions	
Vesicles	Small fluid-filled papule
Pustules	Small papule filled with purulent fluid
Bullae	Large blisters with clear, serous, or hemorrhagic fluid (Figs. 1.1–1.8)

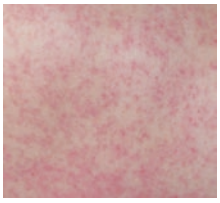

Fig. 1.1 Macules: These lesions are flat and <1 cm; in this case, there are blanchable erythematous macules due to a mild cutaneous adverse drug reaction.

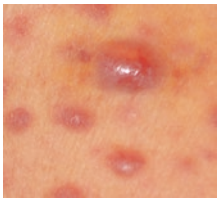

Fig. 1.2 Papules: These lesions are small, <1 cm, raised, palpable bumps, in this case due to leukemic cells infiltrating the dermis.

Fig. 1.3 Patches: These are broad, >1 cm, flat areas with minimal surface change or very fine scale, as shown here in a case of mycosis fungoides.

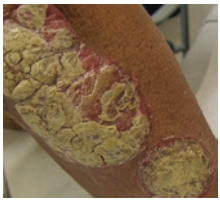

Fig. 1.4 Plaques: These are broad, slightly elevated "plateaus;" this case of psoriasis also had extensive adherent scale.

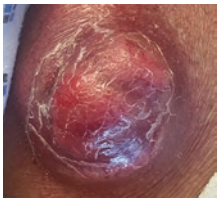

Fig. 1.5 Nodule: This large, 2–3 cm dermal-to-subcutaneous growth is protruding out from the dermis due to metastatic cancer.

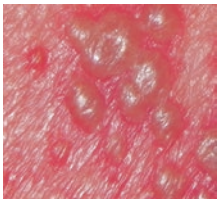

Fig. 1.6 Vesicle: A small <1 cm lesion filled with clear fluid; if filled with pus, may be referred to as a "vesiculopustule".

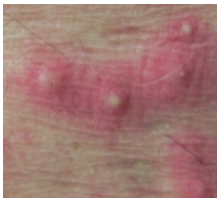

Fig. 1.7 Pustule: A papule or vesicle filled with pus, which may vary in size from near-microscopic to larger, almost bullous lesions.

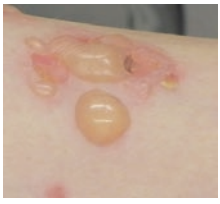

Fig. 1.8 Bullae: These are tense, fluid-filled blisters, as seen in this case of bullous pemphigoid.

Color

When describing the color of a skin eruption, it is best to simply describe what you see, rather than trying to use the "correct" term. Too often lesions are described as "erythematous" by default; one problem with that descriptor is that if it is the only descriptor used, it loses its meaning. The term erythematous should be reserved to refer to lesions that are pink and blanchable, where the color resolves with gentle pressure, signifying inflammation. In general, pink lesions imply inflammation, red lesions imply there has been damage, purple lesions imply there is a concerning infiltrate or ongoing damage, and black lesions imply death or dying (Figs. 1.9–1.13).

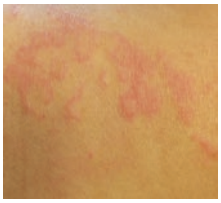

Fig. 1.9 Pink: This very faint erythema is a sign of mild inflammation, as seen in this case of an early urticarial drug reaction.

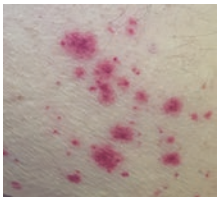

Fig. 1.10 Red: This color is non-blanching, illustrating that there is very intense inflammation or damage, as in this case of small vessel vasculitis.

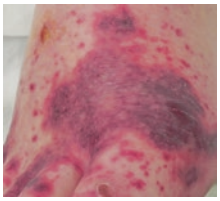

Fig. 1.11 Purple: This color is usually a sign of some form of tissue damage; in this case, confluent red lesions of vasculitis growing together and showing purple due to the amount of vascular injury and extravasated blood.

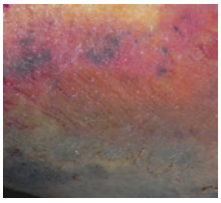

Fig. 1.12 Purple and Black: These colors suggest intense inflammation or damage occurring in the skin. This case of angioinvasive fungal infection is purple due to vascular destruction and extravastated blood, and black at sites of tissue ischemia and early necrosis.

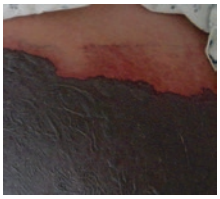

Fig. 1.13 Black: This broad area of necrotic skin has turned black from hypoperfusion, ischemia, and tissue necrosis due to warfarin necrosis.

Secondary Characteristics

Secondary characteristics refer to additional features of the lesions which can be diagnostic clues to their underlying etiology. These are generally extra clinical findings which develop in association with primary lesions, often as a result of change over time. Secondary changes can also include whether there has been ulceration of a lesion, lichenified thickening of the skin, scale build-up on top of a lesion, adherent serous crusts, or malodorous bacterial superinfection, all of which imply some chronicity (Figs. 1.14–1.18).

Secondary change	Description
Crust	Serous fluid which dries on the skin; color may vary depending on the etiology (e.g. honey-colored crust is common in impetigo)
Scale	Adherent fine flakes of skin; thickness may vary depending on the etiology (e.g. thick silvery scale in psoriasis, vs. fine scale in graft-v-host)
Lichenification	Thickening of the skin with accentuation of the normal skin markings (often a result of chronic scratching)
Fissure	A linear erosion or crust (variety of causes, e.g. physical factors (moisture damage in skin creases), infections (herpes), or inflammation (Crohn disease))
Erosion	Superficial damage to the skin involving the epidermis (e.g. ruptured bullae in pemphigus or opened vesicles in varicella)
Ulcer	A deeper injury to the skin resulting in exposed dermis or subcutaneous structures (severity varies by depth, may extend to muscle/bone; multiple causes including physical factors (pressure ulcers), infection, or inflammatory diseases)
Scar	The end result following injury to the skin; occasionally the characteristics of the scar may serve as a diagnostic clue (e.g. cribriform scarring is characteristic of healed ulcers of pyoderma gangrenosum)

Fig. 1.14 Erosions (with a few vesicles): These flaccid, small vesicles and vesiculo-pustules from herpes simplex are easily ruptured, leaving shallow erosions exposed, which can grow together into a broad, confluent erosion, as shown on the right.

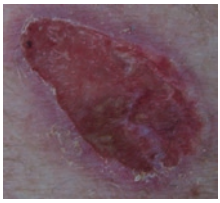

Fig. 1.15 Ulcer: an area of tissue loss through the entire epidermis and into the dermis or deeper layers.

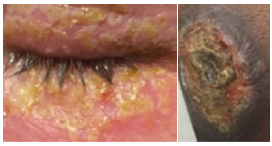

Fig. 1.16 Crust: An adherent layer of dried serous exudate often admixed with surface bacteria. The left image shows orange-yellow, honey colored crust is characteristic of *Staphylococcal* impetigo, as seen here in a patient with superinfected herpes simplex virus infection. The right image is a thicker crust over a deeper wound, with fibrin and dried serous crust overlying a shallow ulcer.

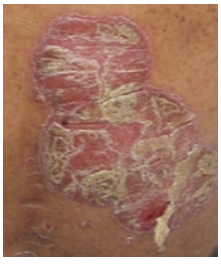

Fig. 1.17 Scale: An area of thickened, hyperkeratotic epidermis which can often be peeled back or picked off.

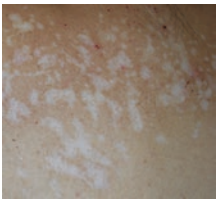

Fig. 1.18 Scar: Sclerotic, damaged skin at a site of prior injury.

Beyond primary lesions and secondary characteristics, another key diagnostic clue is the grouping, pattern, and distribution of skin lesions. Lesional distribution is best thought of in broad categories, such as whether the lesions are localized, diffuse, or limited to specific areas, such as flexural exanthems, dermatomal eruptions, or geometric shapes. Additionally the patterns or groupings of lesions in these areas are important to note, such as whether the lesions are annular, linear, or angulated. More specific localization, such as dermatomal, acral, or intertriginous accentuation, or perifollicular, can be aid in identifying and diagnosing certain diseases.

While appropriately describing a dermatologic eruption can be useful when calling a consult or discussing a case with a remote dermatologist, in the evaluation of complex hospitalized patients, a skin biopsy and histologic assessment coupled with clinical-pathologic correlation is often essential to making accurate, rapid diagnoses. There are two main biopsy techniques: Shave biopsy, which is most commonly used to remove single lesions or intact bullae, and punch biopsy, which allows deeper sampling of the dermis and subcutis and can be closed with sutures. Large lesions may rarely require excisional biopsy, or removal of the entire lesion, while some diagnoses with deeper pathology may require incisional biopsy, or a wedge or ellipse cut into part of the lesion to obtain a broad, deep specimen. In most cases, a punch biopsy of a representative lesion will suffice.

Generally when biopsying inflammatory dermatoses, it is best to biopsy a relatively newer lesion. Most often this means a punch biopsy of the leading edge of inflammation, although there are a number of exceptions and if in doubt it is best to consult with an experienced dermatologist. To exclude infection, sterile tissue culture may be performed by a similar method, i.e., a 4-mm punch biopsy of inflamed skin. This is particularly important when evaluating immunosuppressed patients or when biopsying conditions that are expected to demonstrate substantial neutrophilic infiltrates on pathology (such as Sweet syndrome), in which cases it may be important to correlate the pathology with microbiologic culture data to exclude infection. If evaluating a patient with suspected vasculitis, immunofluorescence studies may be helpful, and it is important to biopsy a fresh lesion for direct immunofluorescence (DIF). When evaluating bullous lesions, a DIF may be helpful as well–however, in that case, the specimen is taken from uninvolved perilesional skin. Immunofluorescence studies allow examination of antibody deposition in the superficial skin. This is often essential in differentiating between certain diagnoses, particularly the autoimmune blistering dermatoses, where the immunofluorescence pattern often defines the disease. Immunohistochemistry is another invaluable tool for dermatopathologists to hone in on a specific diagnosis histologically, with special stains to highlight microorganisms, distinguish specific cell types or highlight deposits of material within the skin.

Bedside Diagnostic Techniques

Additional bedside diagnostic techniques besides may be helpful in narrowing down a differential diagnosis. If a superficial skin fungal infection is suspected, one can wet the skin with an alcohol pad and use a 15-blade to scrape a thin layer of scale onto a glass slide to examine with chlorazol black or potassium hydroxide; the presence of thin branching hyphae can confirm the diagnosis. Similarly, when evaluating a patient with vesicles, simply piercing a vesicle and using a 15-blade to scrape the base onto a slide (Tzanck smear) can allow rapid staining to look for characteristic multinucleated cells and/or nuclear molding suggestive of a herpes-virus-family infection. When evaluating a patient with history and exam findings suggestive of a potential scabies infestation, it is important to know how to scrape and where (and on what magnification) to examine the slide for evidence of the mite, eggs, or feces. Generally, a drop of mineral oil on a 15-blade and a rigorous scraping of scaly web spaces or papular lesions on the hands—to the point of drawing a scant amount of blood—can obtain a sufficient specimen to allow low-power scanning for circular or oval shapes suggestive of mites or eggs. More advanced bedside diagnostic techniques include performing touch preps with the punch biopsy specimen to quickly look for evidence of angioinvasive fungal infections, or India-ink staining to evaluate for Cryptococcus.

Evaluation and Management

Evaluating inpatients using morphology, bedside diagnostic techniques, and skin biopsy can help lead to a narrow, focused differential diagnosis. However, many inpatients are acutely ill—and may be presenting with an early, undifferentiated pattern of a skin disease which will later blossom into a recognizable, diagnosable, and treatable entity. When initially evaluating inpatients, it is often enough to place each patient's eruption into a broad category: Benign (if there is only blanchable erythema, or a localized, minimally symptomatic eruption, or a single banal appearing lesion); dangerous (if there is evidence of skin damage, purpura, necrosis, blisters, or lesions in a suppressed host); or uncertain. If the eruption appears benign, many patients can be reassured and monitored, and may often be treated and supported through their hospitalization despite their rash. If the eruption is concerning or dangerous, it should be managed appropriately. The most challenging case is where there is uncertainty; a widespread morbilliform eruption which spares the face and lacks characteristic features of a systemic hypersensitivity reaction like DRESS, for instance. While mild morbilliform eruptions may be "treated through," and DRESS warrants treatment with systemic steroids, a widespread non-DRESS morbilliform eruption may warrant close monitoring and further workup, to ensure there is no sign of subtle systemic inflammation.

When managing inpatients for dermatological diagnosis, it is important to remember that the inpatient setting is quite different than the outpatient arena. While patients are often sicker and more medically complicated than most outpatients with dermatologic issues, there are a number of advantages to treating inpatients. First and foremost is that patients can be seen on a daily basis. This allows for close clinical follow-up and medical monitoring, thus making it easier to decide to "treat through" certain eruptions and closely monitor patients for progression. For more concerning eruptions, pathology is often rapidly available. It may take a phone call, but most hospital-based pathology labs can turn around a skin biopsy specimen in 24 h, and pathologists are often happy to be contacted with clinical information to help ensure clinical/pathologic correlation—which can help lead to a rapid, accurate diagnosis.

Furthermore, in the inpatient setting other consultants are often readily available. If patients are suspected of having an autoimmune disease, outpatients may wait weeks to see a rheumatologist, yet consultation rarely takes more than 24 h for hospitalized patients. Similarly, if a patient is seen with small-vessel vasculitis and it is unclear whether their urinalysis is concerning, it is quite simple to request a nephrologist evaluate the patient and spin the urine. Additionally, having patients in a monitored setting often makes it easier to initiate certain treatments. At home, recommending a "soak and smear" with topical steroids for a widespread dermatitis may be met with resistance as patients are reluctant to have ointment on their clothing or bedding. Inpatients can easily be wrapped in damp towels, have thick layers of greasy topical steroids applied, and be placed in a sauna suit, for rapid treatment of broad body surface areas with mid-to-high-potency topical steroids twice daily. This can result in rapid improvement in many cases. It is also important to remember that when patients are admitted and being seen on a daily basis, it may be reasonable to use higher potency, stronger medications than one would otherwise prescribe. We frequently recommend a single day of triamcinolone or clobetasol for facial eruptions in the inpatient setting, knowing that, while there are concerns about the long-term safety of high-potency steroids on the face or in skin folds, hospitalized patients' medications can be adjusted on a day-to-day basis and there is no concern for self-administered long-term overuse or misunderstanding of directions. One day of high-potency steroids can often clear an eruption that as an outpatient might take weeks to resolve. This can be helpful in time-sensitive situations, for instance, in vascular surgery patients with inflamed intertriginous eruptions that impair safe transcutaneous vascular access procedures through the inflamed skin.

Perhaps most importantly, in the inpatient setting it is quite easy to assess response to treatment. Through daily assessment of the patient's lesions, the main concept we would emphasize is to ask each day whether the patient requires continued hospitalization on the basis of their skin condition. Patients may be admitted for autoimmune blistering diseases such as bullous pemphigoid, and while it may be important to make a diagnosis during their stay, patients (and their doctors) should realize that even with appropriate therapy, it may take some time for new bullae to cease and old erosions to start to heal. These patients do not need to be admitted for the entire process. More importantly, however, is to recognize when treatments are failing. In such cases, one must always ask whether the wrong treatment is being used, or if the diagnosis needs to be reassessed. Frequently physicians can become fixated on a specific