

Textbook of Hand Eczema

Ali Alikhan
Jean-Marie Lachapelle
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Editors

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 Springer

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To my grandmother, Amma, for teaching me the meaning of love and sacrifice. Without her selflessness, kindness, and generosity, I would have never made it this far in life.

To my mother and father, who have been loving, supportive parents and incredible role models. Their passion, honesty, and perseverance provided me with a foundation to build upon.

To my fiancée, Sara, the love of my life, my soul mate, and my better half. I am truly blessed to have your love, support, and patience, all of which helped me complete this book.

Ali Alikhan

*To Torkil Fischer, Arthur Rook, and Jean Fousserieau
Jean-Marie Lachapelle, Howard I. Maibach*

Preface

Hand eczema is a ubiquitous problem, affecting many people worldwide and resulting in lost work productivity and diminished quality of life.

Fortunately, we are continuing to learn more about the hand and more about hand eczema. Hand eczema is far more heterogeneous than originally thought, and this heterogeneity has implications for management.

Moreover, it is important to be aware of the various causes of hand eczema, diagnostic modalities, and the populations most predisposed to develop the disorder.

Advances in treatment of hand eczema have provided physicians with more tools to improve their patients' lives. Nonetheless, appropriate education is the cornerstone to any treatment plan.

It is our hope that this volume stimulates thought and discussion on hand eczema and provides a unique resource to allow for better understanding of disease heterogeneity, current management options, and future avenues for advancement.

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Abbreviations

2-HEMA	2-Hydroxyethyl methacrylate
2-HPA	2-Hydroxypropyl acrylate
8-MOP	8-Methoxypsoralen
ACD	Allergic contact dermatitis
ACU	Allergic contact urticaria
AE	Atopic eczema
AHA	Alpha-hydroxy acids
AMP	Antimicrobial peptide
BBUVB	Broadband ultraviolet B (320–270 nm)
BCC	Basal cell carcinoma
BHT	Butylated hydroxytoluene
BIT	Benzisothiazolinone
BP	Bullous pemphigoid
BTK	Behind-the-knee test
BTX-A	Botulinum toxin type A
CARD	Contact allergen replacement database
CBS	N-Cyclohexyl-2-benzothiazolesulfenamide
CHD	Chronic hand dermatitis
CHE	Chronic hand eczema
CIM	Colorimetric indices of mildness
CSM	Corneoxenometry
CSSS	Cyanoacrylate skin surface stripping
CTCL	Cutaneous T-cell lymphoma
CU	Contact urticaria
CUS	Contact urticaria syndrome
CXM	Corneoxenometry
DBTU	Dibutylthiourea
DCR	Dental composite resin
DEA	Diethanolamine
DETU	Diethylthiourea
DGEBA	Diglycidyl ether of bisphenol A
DHA	Dehydroabiatic acid
DIDP	Di-isodecyl phthalate
DLQI	Dermatology life quality index
DMTU	Dimethylthiourea
DNFB	Dinitrofluorobenzene

DPG	1,3-Diphenylguanidine
DPTD	Dipentamethylenethiuram disulfide
DPTU	Diphenylthiourea
DSCG	Disodium cromoglycate
DTDM	Dithiodimorpholine
ECM	Extracellular matrix
EDEN	European Dermato-Epidemiology Network
EDTA	Edetic acid
EGDMA	Ethylene glycol dimethacrylate
ETU	Ethylenethiourea
FDA	Food and Drug Administration
FIOH	Finnish Institute of Occupational Health
FLG	Filaggrin
FROD	Finnish Register of Occupational Diseases
GTP	Guanosine triphosphate
Gy	Gray
HDSS	Hyperhidrosis disease severity scale
HECSI	Hand eczema severity index
HHIQ	Hyperhidrosis impact questionnaire
HRIPT	Human repeated insult patch test
HRQOL	Health-related quality of life
HVL	Half value layer
ICD	Irritant contact dermatitis
IGA	Investigator's global assessment
IMPDH	Inosine monophosphate dehydrogenase
IPDA	Isophorone diamine
IPPD	N-Isopropyl-N'-phenyl-p-phenylene diamine
J/cm ²	Joules per centimeter squared
LDI	Laser Doppler imaging
LD-RT	Low-dose radiation therapy
LDF	Laser Doppler flowmetry
LE	Lupus erythematosus
LFA-3	Leukocyte-function-associated antigen 3
LUH	Localized unilateral hyperhidrosis
MBTS	Dibenzothiazyl disulfide
MCI/MI	Methylchlorisothiazolinone/methylisothiazolinone
MDA	4,4'-Methylenedianiline
MDI	Diphenylmethane-4,4'-diisocyanate
MEA	Monoethanolamine
MF	Mycosis fungoides
MI	Methylisothiazolinone
MMA	Methyl methacrylate
MMBT	Morpholinomercaptobenzothizole
MWF	Metalworking fluid
MXDA	m-Xylylenediamine
NACDG	North American Contact Dermatitis Group
NBR	Nitrile butadiene rubber
NBUVB	Narrowband ultraviolet B (313–308 nm)
nm	Nanometer

NMF	Natural moisturizing factor
NMSC	Non-melanoma skin cancers
NO	Nitrous oxide
NOSQ-2002	Nordic occupational skin questionnaire
NRL	Natural rubber latex
OCD	Occupational contact dermatitis
OCD	Occupational dermatitis
OHSI	Osnabrueck hand eczema severity index
OIT	Octylisothazolinone
OSD	Occupational skin disease
PAAB	p-Aminoazobenzene
PCD	Protein contact dermatitis
PCT	Porphyria cutanea tarda
PGE	Phenylglycidylether
PML	Progressive multifocal leukoencephalopathy
PMMA	Polymethyl methacrylate
PPD	p-Phenylenediamine
PPE	Personal protective equipment
PUVA	Psoralen plus UVA
PVC	Polyvinyl chloride
ROAT	Repeated open application test
SACD	Self-adhesive-coated disc
SC	Stratum corneum
SCC	Squamous cell carcinoma
SCORAD	Scoring of atopic dermatitis scale
SLS	Sodium lauryl sulfate
SPT	Skin prick test
TAC	Tacrolimus
TBTD	Tetrabutylthiuram disulfide
TCI	Topical calcineurin inhibitor
TCs	Topical corticosteroids
TEA	Triethanolamine
TETD	Tetraethylthiuram disulfide
TEWL	Transepidermal water loss
TMTD	Tetramethylthiuram disulfide
TMTM	Tetramethylthiuram monosulfide
TNF- α	Tumor necrosis factor α
TREGDA	Triethyleneglycol diacrylate
TREGDMA	Triethyleneglycol dimethacrylate
TRITs	Tandem repeated irritation tests
TU	Thiourea
UEDMA	Urethane dimethacrylate
UVA	Long-wave ultraviolet irradiation (400–320 nm)
UVB	Short-wave ultraviolet irradiation (320–270 nm)
wb MWF	Water-based MWF
ZDBC	Zinc dibutyldithiocarbamate
ZDEC	Zinc diethyldithiocarbamate
ZMBT	Zinc 2-mercaptobenzothiazole
ZnSO ₄	Zinc sulfate

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The Hand: An Anatomoclinical Approach

Jean-Marie Lachapelle

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1.1 Introduction

The hand has always fascinated humanity, due to its unique characteristics. On the walls of Cosquer Cave, an underwater cave in Marseilles, France, prehistoric paintings include mysterious stencils of human hands.

Painters and sculptors have devoted their time to accurate reproductions of the hand.

In this respect, there is a wonderful museum in Lausanne (Switzerland) that is entirely dedicated to all sociocultural aspects of the hand [1].

The hand is well defined in Wikipedia (the free encyclopedia) [2]. It represents a very stimulating approach to this chapter. It is defined as a prehensile, multi-fingered extremity located at the end of an arm or forelimb of primates such as humans, chimpanzees, monkeys, and lemurs. Interestingly enough, a few other vertebrates, such as the koala (which has two opposable thumbs on each “hand” and fingerprints remarkably similar to human fingerprints), are often described as having either “hands” or “paws” on their front limbs.

1.2 The Human Hand: A Unique Structure

As far as we are concerned, the human hand is a unique structure, when compared to other parts of the body, and it is closely related to our environment. For example:

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- The hands are used for both gross motor skills (such as grasping a large object) and fine motor skills (such as picking up a small pebble).
- As explained later on, the fingertips contain some of the densest areas of nerve endings on the body and are, therefore, the richest source of tactile feedback.

It is generally accepted that each hand is dominantly controlled by the opposing brain hemisphere, so that handedness (i.e., the preferred hand choice for single-handed activities, such as writing) reflects individual brain functioning.

This chapter is exclusively devoted to skin characteristics of the hand and is focused on some particularities that deserve special attention for an accurate understanding of lesions encountered in hand eczema.

There are hundreds of publications referring to the skeleton, the muscles, the tendons, the joints, the topography of vessels and nerves, and so forth, but they are beyond the scope of the current textbook.

1.3 Some Anatomical Remarks About the Fingers

A few observations about the five digits of the hand will help one to comprehend some characteristics of hand eczema, which is fully explained in the next chapters.

The terminology related to fingers is universally accepted. The thumb is located on one of the sides, parallel to the arm. A reliable way of identifying “true” hands is from the presence of opposable thumbs. Opposable thumbs are identified by the ability to be brought opposite to the fingers, a muscle action known as opposition.

The four other fingers can be folded over the palm, which allows the grasping of objects. Each finger, starting with the one closest to the thumb, has a colloquial name to distinguish it from the others:

- Index finger, pointer finger, or forefinger
- Middle finger or long finger
- Ring finger
- Little finger, pinky finger, or small finger

As far as the length of fingers is concerned, there is a dimorphism between males and females. The ring finger is proportionally longer than the

index finger in men, whereas the index finger is proportionally longer than the ring finger in women. This is a very old observation. We have confirmed it in a recent study conducted in a cohort of 100 males and 100 females. The mean length of the ring finger was 7.96 ± 0.11 cm in men and 7.46 ± 0.17 cm in women. The mean length of the index finger was 7.64 ± 0.13 cm in men and 7.93 ± 0.08 cm in women (unpublished data).

Although correlation studies suggest that digit ratios reflect prenatal exposure to androgens, the developmental mechanism underlying sexually dimorphic digit development remains unknown. Nevertheless, recent studies have identified previously undescribed molecular dimorphisms between male and female limb buds and have provided experimental evidence that the digit ratio is a lifelong signature of prenatal hormonal exposure [3].

In another paper from the United Kingdom [4], it was demonstrated that men with index fingers longer than their ring fingers (inverted ratio) had a lower prostate cancer risk [5].

1.4 The Hand: A Mosaic of Various Juxtaposed Skin Structures

It is obvious that the skin of the hand is a very complex anatomoclinical entity. Other areas of the body share similar skin differences – for instance, the feet and the face. But, due to its vulnerability to aggressive agents, the hand deserves special attention. It is an important issue for dermatologists, occupational physicians, general practitioners, and nursing personnel. The term “mosaic” is most probably appropriate and of great help for a better understanding of various characteristics of hand eczema. When tracking fundamentals of occupational dermatology, it is important to focus on these anatomical aspects for a better understanding of several pathologies.

Most physicians divide the hand into two skin structures: the dorsum (back) of the hand and the palm. The fingers are considered separately. While this view is basically correct, it is an oversimplification of the entity. An extended view is fully explained in the next sections.

Fig. 1.1 The skin of the dorsum of the hand is thin, soft, and pliable



1.5 The Dorsum of the Hand

1.5.1 Clinical Aspects

The skin of the dorsum of the hand is generally considered very similar to the skin of the extensor aspect of the forearm.

The skin is thin, soft, and pliable so that it can recoil when the fingers are stretched. In young adults, veins may be apparent or not (Fig. 1.1).

Some areas may be hairy, mainly the latero-external sides of the hand and the back of the fingers. In occupational dermatology, when mineral oils were extensively used in many factories, these areas were classical sites for the occurrence of comedones and the so-called oil folliculitis, a rare condition nowadays [6].

1.5.2 Histological Features

The histological pattern of the dorsum of the hand and the dorsal aspect of the fingers, in formalin (or Bouin's solution)-fixed specimens, can be described as follows (Fig. 1.2):

- The rete ridges are prominent, as compared to the forearm skin, where they are flatter.
- The stratum granulosum is thick, usually three or four layers.

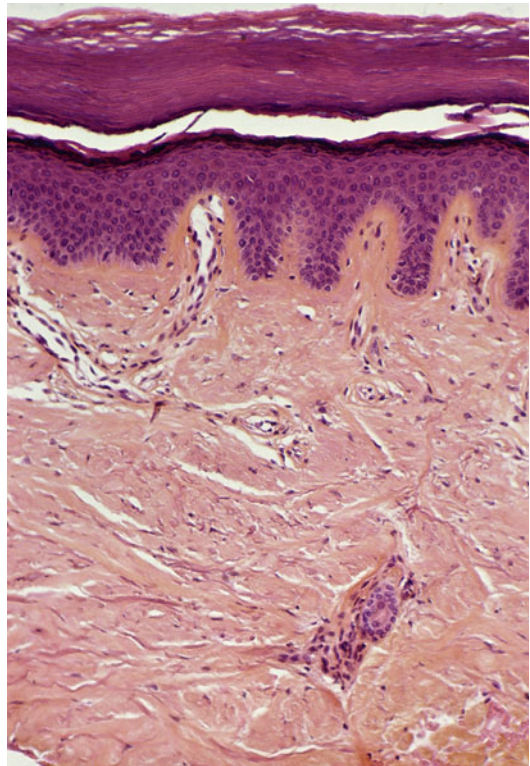


Fig. 1.2 Histological pattern of the skin of the dorsum of the hand (see text). Hematoxylin-eosin-saffron stain $\times 100$

- The stratum corneum appears compact, often artificially separated from the stratum granulosum, due to fixations.

- Sometimes, the “basket-weave” architecture is observed in its upper layers.
- The dermis does not present specific features. Capillaries are abundant in the subepidermal area. Numerous elastic fibers play an important role in the flexibility of the skin in children and young adults. Sebaceous glands are absent. There are no corpuscular nerve endings.

The skin thickness of the dorsal hand has been precisely evaluated by histological measurements [7]. The thickness of the skin (epidermis plus dermis) ranged from 138 to 189 μm , and the thickness of the epidermis accounted for 3.6–16.8 % of the entire skin, as in most other body regions.

In a recent study, based on multiphoton laser tomography, the thicknesses of the total epidermis, viable epidermis, and stratum corneum and depth of papillary dermis were compared at the dorsal forearm and the dorsum of the hands. The results were calculated from depth-resolved intensity curves after correlation with multiphoton images [8]. They showed consistently that in all age groups, the four morphometric parameters were significantly higher on the hand compared to the forearm, while, surprisingly enough, there were no differences between age groups.

1.5.3 Some Regional Particularities

Regional particularities are important to be mentioned for a better comprehension of some characteristics of hand eczema:

- The skin covering the metacarpodigital joints is prominent when the hand is being flexed and, therefore, highly susceptible to mechanical and/or chemical aggressions. This involves rugosity and eventually crevices.
- The same remark can be applicable to the skin covering the interdigital proximal joints. But there is an additional anatomical feature worth noting. When the hand is being extended, this area is like a volcanic crater (i.e., a circular depression surrounded by skin pads). It is an ideal reservoir to store fluids or dust particles and is therefore a site of predilection for irritant contact dermatitis (Fig. 1.3).



Fig. 1.3 The skin of the dorsum of the fingers covering the interdigital proximal joints. When the skin is being extended, this area is like a volcanic crater (i.e., a circular depression surrounded by skin pads) (see text)

- The eponychium is a fragile area at the extremity of the fingers. Its anatomical features are described in Chap. 4.

1.5.4 Aging and Photoaging

Like other sun-exposed areas of the skin, the dorsum of the hands is subjected to important anatomical alterations in the older population, due to the combined action of intrinsic aging and cumulative photoaging.

The main structural changes are as follows:

- Epidermal atrophy. The rete ridges disappear progressively. The stratum granulosum is thin, and the stratum corneum remains compact.
- The dermal tissue is completely disorganized. The elastic fibers are scarce; the collagen fibers become elastotic. These changes lead to an increased fragility of the skin. Fingers are less affected by the evolutive process.
- The clinical consequences are obvious: the veins are very apparent and dilated; minor traumas induce hemorrhages (Bateman’s purpura) (Figs. 1.4 and 1.5). Actinic keratoses and lentiginos are common in older people.

1.6 The Palm of the Hand

For clarity, the anatomoclinical features of the palm are described separately from those specifically characteristic of the pulps of the fingers.