Anatomy and Physiology of the Skin

Content Creators:
Members of the South West Regional Wound Care Program’s Clinical Practice and Knowledge Translation Learning Collaborative

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Learning Objectives

1. Develop a basic understanding of the characteristics of the various layers of skin and its underlying structures

2. Review the primary functions of skin

3. Understand some of the factors that may negatively affect skin integrity

4. Reflect on the effects of aging on skin

5. Identify some preventative interventions to reducing a persons risk of impaired skin integrity
Photographs and Illustrations

• Images/illustrations obtained via Google Images
SKIN AND ITS UNDERLYING STRUCTURES
What is Skin\(^1\)?

- The body’s largest organ contributing to one sixth of the total body weight
- Covers 20 square feet in area (adult)

- Three primary layers:
  - Epidermis
  - Dermis
  - Subcutaneous tissue
Epidermis

- The outmost/top layer of the skin (protective layer)
- Has an average thickness of 0.1mm (15-100 cell layers)
- Avascular (no blood vessels)

- Divided into five sub layers:
  - Stratum corneum
  - Stratum lucidum
  - Stratum granulosum
  - Stratum spino summar
  - Stratum basale
Stratum Corneum

- Avascular
- Multilayer
- Barrier to environment and prevents transepidermal water loss:
  - Dressing adhesives can strip stratum corneum and cause transepidermal water loss
- Involved in formation of an acid mantle:
  - Makes skin less permeable to water
  - Protects skin from microorganism invasion
## Skin pH

### Normal skin pH
- (4 - 6.5)

### Open wound pH
- (6.5 – 8.5)

<table>
<thead>
<tr>
<th>Common Substances</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrochloric Acid (1 mol/L)</td>
<td>0.0</td>
</tr>
<tr>
<td>Gastric Juices</td>
<td>1.0</td>
</tr>
<tr>
<td>Lemon Juice</td>
<td>2.2</td>
</tr>
<tr>
<td>Vinegar</td>
<td>2.4</td>
</tr>
<tr>
<td>Tomato Juice</td>
<td>4.1</td>
</tr>
<tr>
<td>Urine</td>
<td>6.0</td>
</tr>
<tr>
<td>Pure Water</td>
<td>7.0</td>
</tr>
<tr>
<td>Blood</td>
<td>7.4</td>
</tr>
<tr>
<td>Baking Soda Solution</td>
<td>8.4</td>
</tr>
<tr>
<td>Toothpaste</td>
<td>9.9</td>
</tr>
<tr>
<td>Milk of Magnesia</td>
<td>10.5</td>
</tr>
<tr>
<td>Household Ammonia</td>
<td>11.9</td>
</tr>
<tr>
<td>Sodium Hydroxide (1 mol/L)</td>
<td>14.0</td>
</tr>
</tbody>
</table>

Acid Mantle

• Damage to the skin increases its pH and risk of infection

• Diseases/conditions associated with increased skin pH:
  • Eczema
  • Dermatitis
  • Dry skin
  • Diabetes
  • Chronic renal failure
  • CVD

• Urine, stool, perspiration on the skin increases its pH
Acid Mantle Continued

• To maintain acid mantle:
  • Avoid adhesives
  • Use mild pH balanced non-scented skin cleansers
  • Use mild pH balanced non-scented moisturizers
Epidermis

- Contains four distinct layers of cells:
  - Keratinocytes
  - Melanocytes
    - Same number in all skin colors
    - Size and activity greater in darker skin
    - Cells in dark skin more compact therefore skin more resistant to injury
  - Merkel Cells
  - Langerhan Cells (immune function)

- The external layer is almost completely replaced every three to four weeks (continually shedding and reviewing)
Dermis

- Immediately below the epidermis (nourishes epidermis)
  - Fibroblasts, macrophages, mast cells

- Largest portion of the skin

- Composed of two layers:
  - Papillary (superficial):
    - ECM
    - Blood and lymph vessels
    - Epithelial cells
    - Connective and nerve tissue
    - Muscle, fat
  - Reticular (deep):
    - Blood vessels
    - Collagen fibers
    - Connective tissue
Dermis

• Made up of blood and lymph vessels, nerves, sweat and sebaceous glands and hair roots

• Often referred to as true skin

• Functions:
  • Provides tensile strength, mechanical support and protection to the underlying muscles, bones, and organs
  • Regulates temperature
  • Senses the environment
Dermal Appendages

- Includes:
  - Hair follicles
  - Sebaceous and sweat glands (lubricate, control pH, temperature)
  - Fingernails and toe nails

- Originates in dermis and protrude into the epidermis

- Contribute epithelial cells for reepithelialization
Subcutaneous

- A.k.a adipose or hypodermis layer

- Innermost layer of the skin, various thickness

- Composed of fat, blood vessels, and connective tissue

- Functions:
  - Anchors to deep tissue
  - Regulates body and skin temperature (insulates)
  - Stores energy in the form of fat
    - The thicker the adipose layer, the poorer the blood supply through it
THE PRIMARY FUNCTIONS OF SKIN
Function of Skin

- Six primary functions:
  - Supports underlying body structures
  - Temperature regulation
  - A sensory organ for pain, temperature, and touch
  - Eliminates waste
  - A protective barrier between internal organs and the external environment
  - Synthesis of Vitamin D
FACTORS THAT MAY AFFECT SKIN INTEGRITY
Factors That May Impair Skin Integrity

- Dryness
- Age
- Nutrition
- Hydration
- Environment
EFFECTS OF AGING ON SKIN
The Aging Process

- Biological age does not correlate with chronological age

- The rate at which we age is dependent on:
  - Our genes
  - Our environment
  - How we look after our bodies
Effects of Aging on Skin

- 20% decrease in dermal thickness leads to thinning of the skin

- Epidermal-dermal papillae become flattened, increasing susceptibility to friction and shear

- Loss of penetrability to substances in the environment – irritants more readily absorbed

- Elasin fibers are lost – skin less elastic
Effects of Aging on Skin

• Dermis atrophies:
  • Slows wound contraction
  • Increases risk of dehiscence

• Diminished dermis vascularity

• Subcutaneous fat atrophies (most noticeable in face, backs of hands and shins)

• Collagen in the skin reduces (collagen fibers become compressed)
Effects of Aging on Skin

- Blood vessels become thinner and more fragile causing small hemorrhages called senile purpura

- Reduction in sweat glands and sebum resulting in decreased skin hydration (dry, itchy, inelastic skin)
PREVENTION OF IMPAIRED SKIN INTEGRITY
Three Simple Rules

1. Keep the skin clean
2. Hydrate the skin
3. Closely monitor the skin
Keep the Skin Clean

- When skin is clean and has been dried properly, it is less likely to develop infections or wounds.
Hydrate the Skin

• Hydration and lubrication of the stratum corneum necessary to keep skin intact

• Use a mild, non-scented, pH balanced moisturizer to:
  • Prevent damage to the stratum corneum
  • Block penetration of substances into the skin
  • Reduce transepidermal water loss
Monitor the Skin

• Check the skin at least daily (twice is better) and report any problems IMMEDIATELY

• Look closely at:
  • Skin folds
  • Perineum
  • Most common pressure areas:
    • Heels
    • Hips
    • Sacrum
    • Ischeal tuberosities
Monitor the Skin

• Look for and report:
  • Redness
  • Blisters
  • Rashes
  • Open areas
  • Dark colored ‘bruised’ looking areas
  • Dryness
  • Unusual or new lesions
  • Cracked areas
  • Indentation marks that suggest socks or clothes are too tight
  • Areas that feel warmer or colder than usual
  • Unusual swelling
  • Anything that concerns you
Review

1. Characteristics of the various layers of skin and its underlying structures

2. Primary functions of skin

3. Factors that may negatively affect skin integrity

4. Effects of aging on skin

5. Preventative interventions to reducing a persons risk of impaired skin integrity
For more information visit: woundcare.thehealthline.ca
References