Integumentary System
Advanced Pathophysiology
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Integumentary Starting points

- Integumentary (skin) diseases range from benign, like acne, to severe, and life threatening such as malignant melanoma.
- Body' s largest organ (16% body weight/20 sq. feet)
- Barrier to the outside world
- Environment and fluid loss
- Temp control and regulation
- Secretion and absorption
- Vitamin D production
- Immunological surveillance
- Multiple layers to the integument

Layers of the integument

- Barrier against the environment and fluid loss
- Dermis and epidermis
    - Epidermis contains (from bottom to top)
        - Stratum basalis-regenerative stem cell layer
        - Stratum spinosum-desmosomes between keratocytes
        - Stratum granulosum-granules in keratocytes
        - Stratum corneum-keratin in anucleate cells
- Dermis contains
    - Connective tissue
    - Nerve endings
    - Blood and lymphatic vessels
    - Adnexal structures
        - hair shafts
        - sweat glands
            - _____
            - _____
        - sebaceous glands

****If you are unsure of the common descriptions of skin lesions, please review on your own.

Common complaints

- Rash
- Pruritus
- Mole changes
- Wound
- Lesions

Workup involves:

- Physical exam
- History of allergens or exposure
- Culture of area
- Biopsy

Transient papular and pustular lesions

- Milia
- Miliaria
- Sebaceous hyperplasia
- Erythema toxicum neonatorum
- Neonatal cephalic pustulosis (neonatal acne)
- Benign cephalic histiocytosis (BCH)

- The diagnosis is in most cases clinical
    - However, if the diagnosis is in doubt, a skin biopsy for histology and immunostaining should be performed

Inflammatory Dermatoses

Atopic (eczematous) dermatitis

- Pruritic, erythematous, oozing rash w/ vesicles and edema
- Often involves face and flexor surfaces
- Type 1 hypersensitivity reaction
- Associated w/ asthma and allergic rhinitis
- Seborrheic dermatitis
- Greasy, scaly, white or yellowish in sebaceous areas and may be itchy
- Chronic inflammation of the skin usually affecting the eyebrows, scalp, eyelids, ear canals, axillae, chest and back

- Mild cases treated w/ Sulphur, salicylic acid, or tar containing shampoos
- More extensive cases treated with ketoconazole and corticosteroids

Contact dermatitis

- Pruritic, erythematous oozing rash w/ vesicles and edema
- Arises AFTER exposure to allergens
- Poison ivy, nickel (type IV hypersensitivity)
- Irritant chemicals (detergents)
- Drugs (PCN, etc)
- Irritant contact dermatitis is caused by direct toxicity without prior sensitization
- allergic contact dermatitis is a delayed hypersensitivity reaction

- Remove offending agent and topical glucocorticoids (oral if not improved w/ topical)

Acne vulgaris

- Comedones (whiteheads and blackheads) pustules (pimples) and nodules
- Extremely common especially in adolescents
- d/t chronic inflammation or hair follicles and sebaceous glands
- Hormone associated increase r/t sebum glands (androgen receptors) and excess keratin blocks glands >> comedones formed
- Propionibacterium acnes infection produces lipase that breaks down sebum releasing pro-inflammatory fatty acids >> pustule or nodule formed
- RX of benzoyl peroxide is antimicrobial
- Vit A derivatives reduce keratin production

Acne rosacea

- flushing, dilated prominent telangiectases (primarily on the face), persistent facial erythema, inflammatory papules, and pustules on the periorificial face
- Prominence of sebaceous glands on the nose may result in fibrosis and rhinophyma
- underlying cause is currently unknown >>factors or triggers that are known to precipitate the onset include:
- Climatic exposures
- Vasculature
- Chemical and ingested agents
- Inflammation.

Psoriasis

- Well-circumscribed salmon-colored plaques with silvery scale usually in extensor surfaces and scalp
- Pitting nails may also be present
- d/t excessive keratinocyte proliferation
- Possible autoimmune association

- Associated w/ HLA-C
- Lesions often arise in areas of trauma (environmental trigger)
- Histology shows epidermal hyperplasia (acanthus) hyperkeratosis, collection of neutrophils in stratum corneum, and thinning of epidermis resulting in bleeding when picked off (Auspitz sign)
- Treatment of corticosteroids UV light or immune modulators

Pityriasis rosea

- acute, self-limited, inflammatory eruption characterized by a single larger lesion, the herald patch, followed by eruption of smaller oval lesions
- inflammatory skin condition of uncertain etiology
- Lichen planus
- Pruritic, shiny, flat-topped violaceous papules and plaques favoring the extremities.
- planar, polygonal, purple papules often w. white lines on surface (Wickham striae)
- Commonly on wrists, elbows, oral mucosa
- Wickham striae w/ oral involvement
- Histology shows dermal-epidermal involvements “saw tooth” appearance
- Etiology unknown, associated w/ Hep C

Blistering Dermatoses

Pemphigus vulgaris

- Bullous pemphigoid
- Dermatitis herpetiformis
- Erythema multiforme
- Pemphigus Vulgaris
- Presents as skin and oral mucosal bullae acantholysis (separation) of stratum spinosum keratinocytes resulting in suprabasal blisters
- Basal layer cells remain attached to basement membrane
- Thin-walled bullae rupture easily (Nikolsky sign)
- Leads to shallow erosions w. dried crust

- Autoimmune destruction of desmosomes between keratinocytes
- Due to IgG antibody against desmoglein
- Type II hypersensitivity

Bullous Pemphigoid

- Blisters of the skin present usually in the elderly , not usually in oral mucosal
- symmetric and favor the flexural aspects of the extremities, lower trunk, and abdomen

- Due to IgG antibody against hemidesmosome components (BP180) of the basal cell and underlying basement membrane
- Tense bullae do not rupture easily (versus pemp vulgaris)
- r/t autoimmune destruction

Erythema Multiforme (EM)

- Targetoid rash and bullae central epidermal necrosis surrounded by erythema
- Hypersensitivity reaction most commonly associated with HSV, Mycoplasma infections, drug reactions, autoimmune and malignancy
- EM with oral mucosal/lip involvement and fever is Stevens Johnson syndrome (SJS)
- Toxic epidermal necrolysis is severe form of SJS and characterized with diffuse sloughing of skin resembling a burn (usually related to drug reaction)

Epithelial tumors

Seborrheic keratosis

- Raised discolored plaques on extremities and face
- Waxy “stuck-on” appearance
- Squamous cell proliferation, benign common in elderly
- Leser-Trelat sign is sudden onset of multiple keratoses and suggest underlying GI carcinoma

Acanthosis nigricans

- Epidermal hyperplasia with darkening of the skin “velvet like”
- Often in axillae and groin
- Associated with insulin resistance or malignancy

Basal cell carcinoma

- Elevated nodule with central ulcerated crater surrounded by dilated vessels (telangiectatic)
- “Pink Pearl like papule “
- Basal cell proliferation, malignant
- Most common cutaneous malignancy
- Metastasis is rare
- UVB induced DNA damage
- Treatment is surgical excision

Squamous cell carcinoma

- Ulcerated nodular mass usually on face (classically involves lower lip)
- Malignant proliferation of squamous cell with formation of keratin pearls
- UVB induced DNA damage, immunosuppressive therapy, arsenic exposure risk factors
- Actinic keratosis is a precursor lesion presenting as hyperkeratotic scaly plaque often on face, back or neck
- Treatment is excision
- Mets is rare

Disorders of pigmentation and melanocytes

Vitiligo

- Localized loss of pigmentation due to autoimmune destruction of melanocytes

Albinism

- Congenital lack of pigmentation
- d/t enzyme defect that impairs melanocyte production
- Increased risk of squamous cell carcinoma
- Eyes-ocular form OR eyes and skin –oculocutaneous form
- Freckles and melasma
- Freckles
- Small tan –brown macule darkens when exposed to sun
- Increased number of melanosomes, no increased melanocytes

Melasma

- Mask like hyperpigmentation
- Associated with pregnancy and OCP

Nevus (moles)

- Flat macule or raised papule w/ symmetry sharp borders evenly distributed color and small < 6mm diameter
- benign neoplasm of melanocytes
- Congenital present at birth and often associated with hair follicle
- Acquired arises later in life
- Begins as a nest of melanocytes at dermal epidermal junction
- Grows by extension into the dermis (compound nevus)
- Junctional component eventually lost resulting in intradermal nevus

- Dysplasia may arise which is precursor to melanoma
- Called a dysplastic nevus

Melanoma

- Malignant proliferation of melanocytes
- Most common cause of death from skin cancer
- Mole like growth with ABCD
- Asymmetry
- Borders are irregular
- Color not uniform
- Diameter >6 mm
- 2 growth phases
- Radial growth horizontally along the dermis and superficial dermis (low risk metastasis)
- Vertical growth into deep dermis (increased risk of metastasis w/ depth of extension-called Breslow thickness)
- Most important factor of determining metastasis

Variants include

- Superficial spreading = most common subtype- dominant early radial growth results in good prognosis
- Lentigo maligno melanoma =lentiginous proliferation (radial growth) good prognosis
- Nodular = early vertical growth- poor prognosis
- Acral lentiginous = arises on palms or soles often in dk skinned individuals, not related to UV exposure

Infectious disorders

Impetigo

- Erythematous macules progress to pustules (usually on face) rupture results in erosions and dry honey crusted serum
- 2 forms –bullous or non bullous

- Superficial bacterial infection
- Usually d/t s. aureus or s. pyrogens
- Commonly affects children
- Erythematous

Cellulitis

- Erythematous tender rash with fevers
- Deeper dermal and subcutaneous infection usually d/t s. aureus or s. pyrogens
- Etiology includes recent surgery, trauma, or insect bite

- Can progress to necrotizing fasciitis with necrosis of subcutaneous due to infection with anaerobic flesh-eating bacteria
    - Production of CO_2 leads to crepitus
    - Surgical emergency

Verruca (wart)

- Flesh colored papules with rough surface
- HPV infection of keratinocytes
- Hands and feet are common locations

Molluscum contagiosum

- Firm pink umbilicated papules
- d/t poxvirus
- Affected keratinocytes show cytoplasmic inclusions (molluscum bodies)
- Mostly found in children
- Can also be seen in sexually active adults and immunocompromised individuals

Folliculitis

- manifests clinically as erythematous papules or pustules around hair follicles.

- Inflammatory process involving the hair follicle. Causes include bacterial, fungal, viral, and parasitic microorganisms

- Diagnosis is almost always clinical although laboratory tests requested include Gram stain, potassium hydroxide (KOH) preparation, Tzanck smear, culture for microorganisms, and skin biopsy.

Abscesses

- Furuncle

- Carbuncle

HSV (herpes simplex) 1 & 2

- Infection with HSV-1 or HSV-2 can cause oral, genital, and ocular ulcers
- Most people have unrecognized disease
- primary episode occurs during initial infection with HSV, in which the host lacks an antibody response

- HSV type-specific antibody tests are used to diagnose infection with or without lesions and distinguish between type 1 and 2

Herpes zoster

- presents with pain described as burning or stabbing followed by a vesicular rash in the affected dermatome
- primary varicella-zoster virus (VZV) infection because of a decline in the virus-specific cell-mediated immunity

- Diagnosis is primarily based on typical clinical symptoms, such as dermatomal pain and eruption of grouped vesicles in the same dermatome.
- Confirmation can be done using PCR methods

Varicella zoster/ Herpes zoster

- varicella zoster (VZV) and Herpes Zoster (HZ)
- typically presents with fever, malaise, and a widespread vesicular and pruritic rash primarily on the torso and face (VZV)
- disease normally presents in childhood and is usually self-limited
- As the disease progresses, early lesions will begin to scab over as new peripheral lesions develop. This appearance of lesions in "crops" (different stages of acuity/healing) is characteristic of varicella.

- Adults, pregnant women, immunosuppressed patients, and neonates are at high risk of complications, including pneumonia, neurologic sequelae, hepatitis, secondary bacterial infection, and death.

- Herpes Zoster _____

Fungal infections –tinea

- Superficial fungal infection (dermatophyte) with varying presentation depending on site.
- Spread by direct contact
  - People, animals, soil, & fomites
- tinea
  - unguium –nails
  - pedis – athletes' foot
  - Capitus-head
  - Cruris-groin-jock itch
  - _____
  - _____
- Host factors:
  - Sweaty, hot humid climates and personal effects
  - Occupational exposure
  - Contact sports

Yeast infections

- candidiasis (candida species)
- >160 species >>only ~20 cause infections in humans
- C. albicans
- Normal microbiota of GI & GU tract >> do have ability to invade
- Mucous membranes, vagina, GI tract, skin
- Local overgrowth/opportunistic
- Risk factors:
    - Hematological malignancies, chemotherapy, transplant patients, ICU pts.
- Dx by culture/scraping:
    - show micro abscesses and budding hyphae/pseudo hyphae
    - BC

Burns

- Thermal, non thermal, inhalation, radiation, electrical
- Burn wound depth and classification
- first degree/Second degree/third/fourth degree previous way we classified burns
- New way of classification:
    - Superficial
        - Define:
    - Partial thickness
        - Define:
    - Full thickness
        - Define:
    - Deep tissue extension
        - Define:
        - includes muscle, tendon and bone
- Extent of body surface and depth determine severity
- "rule of nines"
    - Define/identify

Pathophysiology of burns

- >40% TBSA is considered major and leads to evaporative H_2O loss; loss of plasma proteins, fluids shifts
- Called burn shock
- Manifests as hypovolemia, hypotension, generalized edema
- Increased capillary permeability last for first 24 hours, altered cell membrane perm also; decreased cardiac contractility, and decreased CO
- Fluid and protein move out of vascular space, leading to profound hypovolemic shock
- Hypercoagulable state increased risk of DIC

Frostnip/frostbite

- Injury to skin via extreme cold

- Commonly affects extremities
- Frostnip differentiated by no tissue injury after re-warming
- Frostbite has ice crystals, direct injury from cold, and endothelial damage

References
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UP TO DATE various topics
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