THE SRUCTURE AND THE FUNCTIONS OF THE SKIN

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BASIC FUNCTIONAL ANATOMY AND HISTOLOGY

EMBRIOLOGY

- Ectoderm---Epidermis +Skin appendages
- Neural crest cells—Nerves + melanocytes
- Mesoderm—Dermis + subcutaneous fat

ANATOMY

- Mature skin consists of : Epidermis, Dermis, Panniculus adiposum
- Basement membrane– undulating pattern with rete ridges and dermal papillae
- DEJ provides mechanical support to epidermis

EPIDERMIS

- Populated by 4 types of cells: keratinocytes,melanocytes, Langerhans cells, Merkel cells(epidermal nerve cells)
- Stratified into several layers:
  - Basal layer – actively dividing cells
  - Stratum spinosum (prickle cell layer)
  - Stratum granulosum
  - Stratum corneum (horny layer)
  - Stratum lucidum (thick skin: palms and soles)

CELLS OF THE EPIDERMIS

- Keratinocytes: collumnar and polygonal cells found throughout the full thickness of the epidermis
  - synthesize keratin--structural support
- Melanocytes: dendritic cells found in basal layer
- - synthesize UV- absorbing pigment melanin
- Langerhans cells: pale dendritic cells found in str. Spinosum
  - contain Birbeck granules seen on EME.
  - APC- immunological function
- Merkel cells– dendritic cells found in str. Basale
  - role in signal transduction of fine touch

BASEMENT MEMBRANE

- Acts as an anchor for the epidermis
- Complex structure visible on EME and at molecular level
- Consists of several layers :
  - lamina lucida –laminin
  - anchoring filaments
  - lamina densa—type 4 collagen
  - anchoring fibrils—collagen 7– fasten BMZ to the epidermis

DERMIS

- Amorphous ground substance synthesized by fibroblasts
- Fibres (collagen, elastin, reticulin)– produced by fibroblasts
- Cells: fibroblasts, macrophages, mast cells
- Vessels– superficial and deep plexuses of arteries, veins,lymphatics
- Nerves– sensory nerves supplying skin and hair follicles, free nerve fibers, special nerve end organs(Meissner and Pacini corpuscles)
- Muscles– smooth muscles(arrector pili, nipple, dartos)

  -- striated muscles : platysma, facial.

EPIDERMAL APPENDAGES

- Pilosebaceous units (hair +sebaceous glands)– found everywhere on skin except on palms and soles
- Sebaceous glands secrete sebum– lubricates skin and hair
- -- antimicrobial action
- They are under hormonal control(androgens)
- Arrector pilli muscles—autonomic control
- Apocrine sweat glands: axillae, perineum, genitalia,nipple
- - functional after puberty
- - under hormonal control(adrenergic)
- Eccrine sweat glands– found on whole skin surface

  -- secrete clear fluid containing urea,electrolytes

  --sympathetic inervation(acetylcholine)

FUNCTIONS OF THE SKIN

- Protection against : chemicals—horny layer, sebum, acidic Ph
- UV-radiation– melanocytes
- Antigens, haptens—LC, Lf., macrophages
- Microbes: horny layer, LC, macroph., mast cells
- Mechanical: subcutaneous fat
- Preservation of a balanced internal environment—horny layer
- (chemical and physical skin barrier)
- Shock absorber– dermis (ellastic fibers, collagen, sbc.fat)
- Lubrication and waterproofing– stratum corneum

FUNCTIONS OF THE SKIN –Ctd.

- Thermoregulation: insulation– fat tissue
- cutaneous blood vessels : vasodilatation/vasoconstriction

  eccrine sweat glands—evaporation

  thermoreceptors
- Immunological role: APC(Langerhans cells), lymphocytes , eosinophils
- Hormonal : sex hormone metabolism (testosterone)—hair follicles & sebaceous glands

  Vit.D production– keratinocytes
- Sensation: thermoreceptors in the skin(heat, cold)

  pressure/vibration receptors in the skin (touch, pain, tickle)

  pruritus—stimulation of subepidermal nerve plexus by chemical mediators
- Display (cosmetic) : -- psychosocial impact of the skin disease

PRINCIPLES OF DIAGNOSIS

- History of the skin complain ALWAYS correlated to general health, previous illness, operations, allergies and chronic or recent drug intake, including self-administration or herbal medication from traditional healers.

HISTORY OF SPECIFIC SKIN COMPLAINT

- Onset: acute/rapid-spreading or insidious
- Duration and precise site of first lesions and type of spreading
- Is this the first attack ? If not—time and duration of previous attacks
- When was the last previous attack?
- What is the duration of each individual lesion?
- Triggering factors: trauma, infections, drugs, hobbies, occupational exposure
- Always ask about traveling (parasites) contacts at home, school, work
- Other previous skin disorders , chronologically since birth
- Family history connected to the current skin complaint

EXAMINATION

- Patient should be completely undressed to assess the rash
- Examine in a good light (day light)
- Make records about : age, sex, race
- General state of health and nutrition
- Site and distribution of lesions (localised/generalised , unilat./bilateral , symmetrical, diffuse, grouped, sun-exposed areas ?)
- Which part of the body is MOST affected ?
- Are there primary or secondary skin lesions ?
- Use both INSPECTION + PALPATION
- Always check the mouth, teeth, scalp, nails, perineum in infants– relevant
- for Congenital diseases

TERMS USED TO DESCRIBE SKIN LESIONS

- PRIMARY SKIN LESIONS :

  - Erythema – localised or diffuse
  - Oedema (swelling)– localised or diffuse
  - Macule--small, flat, circumscribed area of discolored skin
  - Patch – larger , ill-defined macule
  - Papule– small (< 5 mm) solid elevation of the skin , well– defined
  - Plaque– elevated area of the skin > 2cm , palpable, well-circumscribed
  - Weal—pale papule or plaque due to transient oedema in dermis(urticaria)
  - Vesicle– small skin elevation (< 5 mm) containing fluid
  - Bulla– large vesicle (> 1cm) containing fluid
  - ? Pustule– vesicle/bulla containing pus
  - Papilloma– warty outgrowth

PRIMARY SKIN LESIONS– Ctd.

- Petechiae– pinhead -sized macules of blood in the skin
- Purpura– large macules/ papules of blood in the skin
- Echymoses—larger areas of extravasation of blood into the skin
- Haematoma– ill-defined swelling of skin from gross bleeding
- Burrow– linear/ curvilinear lesion caused by scabies mite
- Comedo– a plug of keratin and sebum wedged in a dilated pilosebaceous duct .
- Telangiectasia – visible dilatation of cutaneous capillaries

SECONDARY SKIN LESIONS

- Scale- flake arising from thickened/ abnormal horny layer
- Crust- dried exudate (tissue fluid and blood)
- Scale-crust – keratin of horny layer + exudate
- Erosion – partial loss of epidermis (superficial)
- Ulcer– deeper loss / full thickness loss of epidermis extending into the dermis
- Fissure –a slit in the skin
- Sinus– a cavity or channel that permits the escape of pus + fluid
- Excoriation : erosions produced by scratching

SECONDARY SKIN LESIONS – Ctd.

- Stria– streak like linear , atrophic pink/ purple/ white lesion of the skin due to alterations of connective tissues
- Lichenification– epidermal thickening with resultant prominent skin markings
- Pigmentary changes : hypo-/ hyperpigmentation
- Scar : result of healing in which normal structures are permanently replaced by fibrous tissue.
- Atrophy : thinning of the skin due to diminution of epidermis, dermis and subcutaneous fat

INVESTIGATIONS TO THE SKIN DISORDERS

- AIDS TO INSPECTION : Diascopy, Dermatoscopy, Woods`light
  Capillary microscopy
- AIDS TO PALPATION :
  - Linear pressure
  - Blunt pressure and point pressure
  - Squeezing , Stretching , Rubbing
  - Scratching , Pricking
  - Heat and cold
  - Patch tests – detection of type 4 (CMI-delayed hypersensitivity)
  - Prick tests – detecting type 1 (immediate hypersensitivity)

INVESTIGATIONS – Ctd.

- Skin scrapings + nail clipping + hair pulling – mycological examination
- Tzanck smear test – rapid confirmation of Herpes virus infections
- Skin biopsy – Histology
- Immunofluorescence : DIF + IIF –important role in bullous disorders
- Electron microscopy – role in disorders of keratinization (ichthyoses)

PRINCIPLES OF TREATMENT

- TOPICAL APPLICATIONS
  - Moist lesions– wet dressings or lotions
  - Dry skin – ointments + creams
  - Active ingredients (sulphur, coal tar , corticosteroids)– incorporated into lotions, ointments, creams, pastes.
  - Diluting the active ingredients– over large body areas (UE ,UEA)
- TOPICAL ANTIBIOTICS AND ANTISEPTICS
  - Povidone-iodine (Betadine) cream or oint. Hibitane sol./ cream
  - Antibiotic ointments : Terramycin, Polysporin, Bactroban

SYSTEMIC TREATMENT

- Corticosteroids (Prednisone / Prednisolone)– Acute eczema, SLE, Pemphigus Vulgaris, Leprosy reactions
- Systemic Antibiotics – Skin infections (Erythrom., Cloxacil. Tetracycl.)
- Systemic antifungals: Griseofulvin– Ringwarm (tinea) infections is effective only for Dermatophytes
  - Nystatin/ Mycostatin is effective only in Candida
- Other antifungals : terbinafine (Lamisil) , fluconazole (Diflucan) Itraconazole(Sporanox), Amphotericin B (Fungizone)
- Dapsone (DDS)-- a sulphone used to treat Leprosy, Dermatitis Herpetif. Bullous Pemphigoid, Pustular dermatoses, Vasculitis

SYSTEMIC TREATMENT—Ctd.

- RETINOIDS: Synthetic vitamin A derivates (inhibit keratinization, sebum secretion and inflammation :

  - Isotretinoin (Roaccutane)– severe Acne
  - Acitretin (Neotigason)– severe Psoriasis , Ichthyosis

  NB- TERATOGENIC– CONTRAINDICATED IN PREGNANCY (Roaccutane – one month , Neotigason – two years)

  - Side effects : dryness of the skin & mucosa , rised blood lipids, LFT upset , musculo-skeletal disorders