Concepts	Learning Objectives	
1 Pruritus is the condition of sensory nerve stimulation producing an itching sensation due to signaling through histaminergic (histamine) and nonhistaminergic nerves (cytokines, proteases, etc). The histamine pathway involves binding to H1 and H4 histamine receptors on sensory neurons, PLC-mediated PIP2 cleavage, DAG activation of PKC and subsequent opening of TRPV1 and voltage-gated channels to trigger the action potential for itch signaling.	1 – Define the role of histamine in activation of the histaminergic nerve and subsequent molecular activities leading to action potential generation for pruritus.	8-9
	2 – Distinguish pruritogens involved in nonhistaminergic and histaminergic nerve activation. What cytokines (Th2) are involved in nonhistaminergic nerve activation for pruritus signaling? How are PAR activated? What is the role of SP in pruritus?	10, 12, 14-15
	3 – Define the contribution of MRGPR on mast cells and those compounds that bind to it. Review the pruritus pathway.	16-17
	4 – Recognize exposure-related triggers of pruritus and system causes of itch.	18-20
	5 – Define the mechanisms of type I and IV hypersensitivity and the activity of mast cells to promote pruritus. What are the major pruritogens for wheal and flare immediate responses?	22, 24-28

LO1

★ Histamine = acute itch
- released by mast cells, binds H1 & H4 on histaminergic nerves (Gq)
∴ PLC mediated PIP_2 cleavage & DAG activates PKC to OPEN TRPV1 (both histamine & non) & voltage-gated channels
→ ACTION POTENTIAL

TQ

→ Excited Histaminergic Neurons release:
① CGRP (calcitonin gene related peptide)
② SP (substance P)

★ Nonhistaminergic Nerve Activation
= CYTOKINES
↑ T_H2
★ IL-31 → increased T_H2 response
★ IL-4 & IL-13 → signal 3 T_H2 resp.
★ TSLP → secreted by keratinocytes to stimulate T_H2

TQ

★ Type I Hypersensitivity: Atopic Dermatitis ★

Ex: pollen

① uptake of allergen by DC
② T_H2 expansion
③ production IgE via IL-4
④ release mediators of inflammation upon RE-exposure
⑤ Mast cell stimulation → immediately respond ★

TQ

TIL31 = ↑severity

★ Type IV Hypersensitivity: Allergic Contact Derm. ★
- contact allergens form haptens,
★ effector memory T-cells (T_H1) are generated & trafficz to skin (takes 2 wks)
→ upon re-exposure:
- haptenated proteins on MHC I & II
- $CD8^+$ T-cells produce lesions via apoptosis + MØ
★ Fas expression on keratinocytes
= BLISTERS

Allergens that trigger ACD
Nickel
Latex
Cosmetics
Rhus oils (poison ivy)
Topical meds (benzocaine and neomycin)
Soaps and detergents
Tattoo dyes

TQ

$CD4^+$ T-cells ↑TNFα & IFN-γ → activate mast cells to potentiate itching
= Inflammation & itching

★ T_H1 → TNFα → itching

★ IMMEDIATE RESPONSE:
★ wheal: SP binds to NK1 receptor
★ flare: CGRP (surrounding redness)

Concepts	Learning Objectives	
2 Urticaria (hives) is the condition involving the formation of a well-defined, nonpruritic edematous swelling of the subcutaneous tissues due to immune-mediated (type I hypersensitivity) and nonimmune (neuropeptides) mechanisms of mast cell activation. Pruritus can accompany urticaria but different mechanisms underlie each. Angioedema occurs when the mast cells degranuate in the deep dermis and subcutaneous tissue while urticaria occurs when mast cells degranulate in the upper dermis.	1 – Define the characteristics and causes of urticaria and angioedema.	34-36
	2 – Mast cells are the primary mediators of urticaria and angioedema – recognize the mechanisms of activating mast cells involving type I-IV hypersensitivities. Mast cells can be activated in all. Mast cells are the primary mediator of type I hypersensitivity but can be active in all.	37-40
	3 – Recognize how mast cells can be activated by nonimmune events such as direct binding of agents to mast cell receptors or drug actions and environment.	41-42
	4 – Identify triggers of urticaria (and angioedema) as well as physical presentation of urticaria based upon the trigger. What clinical clues suggest a case of urticaria? What approaches and therapies are available?	42-48
3 When arthropods are disturbed or threatened or require food to continue growth and reproduction, often humans suffer bites, stings, infestations producing skin rashes involving pruritus and urticaria.	1 – Identify from the bite and coloration a millipede bite from other arthropod bites. Differentiate among sting lesions of the southern US caterpillars.	51-58
	2 – Differentiate between the bites of mosquitoes, bedbugs, triatomine bugs, fleas, and lice based upon location and presentation of patient. Distinguish the presentation of scabies infestation from other arthropods.	60-66, 69, 72
	3 – Differentiate brown recluse, black widow, tick, chiggers, and scorpion bites based on presentation, geography, environmental considerations, and symptoms. Contrast with the specific lesions caused by fire ant stings/bites.	66, 70-71, 73-76

→ urticaria = degranulate in upper dermis
→ angioedema = degranulate in deep dermis & subQ

★ Type I Hypersensitivity:
= allergen reexposure binds to IgE triggering mast cell activation (F_cER)
EX: food & drug allergies, bee stings, latex

★ Type II Hypersensitivity: AUTOIMMUNE → HLADR4
= mast cell & basophil $F_cγR$ bind IgG autoantibody (self antigen binds mast cell) insoluble antigen

★ Type III Hypersensitivity:
- chronic Ag → CIC that bind FcR (soluble antigen)
ex: SLE, Hep B, long term Ab

★ Type IV Hypersensitivity:
= upon reexposure, activated memory T-cells produce cytokines (TNFα) ★ ★

TQ

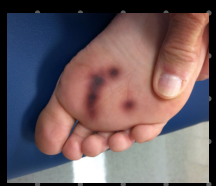
★ COLD & HEAT can activate mast cells = Nonimmunogenic
★ pts w/ hx urticaria/angioedema → EpiPen!

LO2 BITES & STINGS

★ Millipedes:

TQ

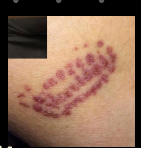
toxin = benzoquinones ★
→ cause skin to turn black for months

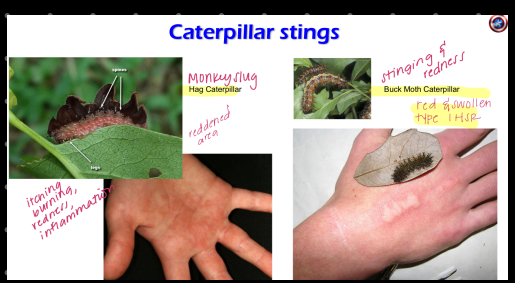


★ Pus Caterpillar oak & elms

TQ

toxin → grid lesions
= HA / Fever / Nausea, Siezures

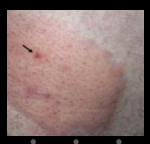




TQ Caterpillar stings:
Tx: scotch tape

★ Bedbugs: bite to feed on blood
- zigzag / linear pattern

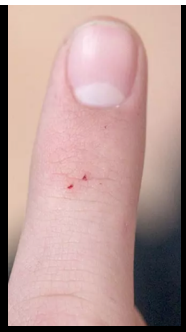
★ Triatomine Bug: transmits T. cruzi
painless bite → papule
& Chagoma if parasite enters eye



★ Scabies: direct contact
Night itching
webs of fingers / toes
white linear curved lines on skin = tunneling

★ Brown Recluse
toxin: hemolytic enzymes → tissue destruction & necrosis

★ Black widow
TWO puncture wounds
TQ
toxin: neurotoxin (α-latrotoxin) → excessive neurotransmitter release
SXS: muscle spasms, CP, LBP, HTN, sweating, N/V, SOB



Difference between bug bites

	Bed bug bites	Flea bites	Mosquito bites
LOCATION	Usually abdomen or arms(upper body)	Usually ankles or feet(lower body)	Can be anywhere
SIZE	Multiple big bites	Many small bites	Fewer big bites
PATTERN	Grouped together in a zig-zag or line	Grouped together, may form a pattern	No pattern

L03/04 Pharm of ID - Derm

CELLULITIS

★ Outpatient:
TQ
- purulent: CA-MRSA → TMP/SMX (ØG6PD, Øchildren), doxycycline, clindamycin, & linezolid ★ (what you give when pt allergic; risk of serotonin syndrome ★ & seizures ★)
- nonpurulent: β-hemolytic strep → cephalexin or amoxicillin (β-lactams)

systemic: β-lactam + [TMP/SMX or tetracycline] OR linezolid OR clindamycin

★ inpatient: MRSA → IV antibiotics

DIABETIC FOOT → MC staph/strep, gram⊖ bacilli anaerobes, or MRSA

mild/mod → target gram⊕ cocci
severe infx → broad spectrum empiric therapy ★
Pseudomonas RF → soaking feet, failed nonpseudo therapy, clinically severe infx ★ → what drug do you give?
vanc + pip/taz or vanc + carbapenem

TQ
★ Surgical propnylaxis → Cefazolin ★

ACNE

★ comedonal: NON-inflammatory
TQ
tx: topical tretinoin
MOA: vitamin A derivative ★
SE: burning

★ MILD papulopustular:
Benzoyl peroxide ± topical AB AND topical retinoid
OR
Benzoyl peroxide AND topical AB (clindamycin)

★ MODERATE papulopustular:
topical retinoid AND oral AB AND topical benzoyl peroxide
→ tetracyclines

★ SEVERE acne

TQ isotretinoin (accutane)

★ HIGH RISK BIRTH DEFECTS → pledge program / pregnancy test every refill

MOA ★ reduces gland size & sebum production

LIDOCAINE

TQ MOA: block Na^+ channels

SE: arrhythmias when you apply to large area (legs)

CORTICOSTEROIDS

thin skin = more absorption ∴ go w/ LOW potency (face) ★

TQ low: hydrocortisone
med: triamcinocione
high: clobetasol

→ SE: can cause skin atrophy

TACROLIMUS

= calcineurin inhibitor

★ alternative for topical corticosteroids @ sites w/ greatest risk of ↑ corticosteroid induced atrophy ★

★ AVOID atrophy!

STEVEN JOHNSONS SYNDROME

TQ
- Sulfa drugs
- Oral hypoglycemics
- Anticonvulsants / antibiotics
- Phenytoin / Penicillin
- NSAIDs

→ AB: penicillins / sulfa
Phenytoin / carbemazepine / lamotrigine / valproic acid
allopurinol

DRUG INDUCED LUPUS → anti-histone antibodies ★ ★ ★ ★

TQ
- Sulfa
- Hydralazine
- Isoniazid
- Procainamide
- Etanercept

PHOTOSENSITIVITY

TQ ?
- Tetracyclines
- Sulfa
- Flouroquinolones
- Amiodorone
- 5-FU

L05 Skin Ulcers

BY THE END OF THIS LECTURE, YOU SHOULD BE ABLE TO:

- Classify the stages of pressure injury.
- Discriminate between arterial ulcers and venous ulcers. Recognize neuropathic ulcers.
- Assess treatments for each of the above ulcer types.

TQ

Pt comes in w/ stage 3 ulcer & it gets better during mgt stay → STILL STAGE 3!

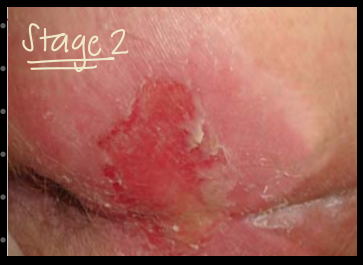
YOU CANNOT REVERSE STAGE A PRESSURE ULCER!!

EXAMPLE: A STAGE 3 ULCER CAN IMPROVE, BUT CANNOT BECOME A STAGE 2. IT IS A HEALING STAGE 3 ULCER.

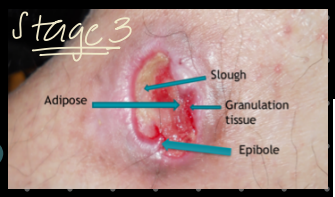
PRESSURE ULCERS:

STAGE 1: nonblanchable erythema, Ø open draining wound
tx: remove pressure + skin protectant

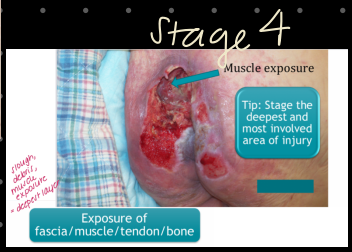
STAGE 2: partial thickness loss of skin w/ exposed dermis
may px as blister
tx: remove pressure + skin protectant



STAGE 3: full thickness loss of skin w/ visible fat in the ulcer & granulation tissue + epibole
may have slough or eschar
tx: offload, moist tx, drainage



STAGE 4: full thickness & tissue loss
w/ exposed / palpable fascia, muscle, tendon, cartilage, or bone
tx: assess for bone infx, debride, skin graft



UNSTAGEABLE eschar / necrotic tissue covering
unable to assess depth

DEEP TISSUE INJURY intact or non-intact skin w/ nonblanchable deep red/purple discoloration
may px blood filled blister

Evaluation & Treatment:

1. remove pressure ★
2. MOIST wound healing ★
3. debridement
4. wound vac

★ + Nutrition

ARTERIAL ULCERS arterial occlusion → claudication / rest pain
"cookie-cutter" punched out lesions
PAINFUL, usually DRY
ankles & feet
dx: ABI

TQ

- > 1.0 = Normal
- < 0.8 = referral for revascularization

systolic →

Right ABI = Highest pressure in Right foot / Highest pressure in BOTH arms

Left ABI = Highest pressure in Left foot / Highest pressure in BOTH arms

tx: revasc (if needed) & moist wound healing
↳ paint w/ betadine until surgery

VENOUS ULCERS d/t venous insuff → high pressure → fluid leaks between leg & ankle
irregular, shallow, painful, EXUDATE
dx: duplex ultrasound + ABI
tx: compress, elevate, pump // vein clinic for ablation → decreases chance of ulcer recurrence ★

& look over Neuropathic ulcers...

LOW Burns

- Understand the consequences of burn induced skin barrier loss
- Identify burns by degree
- Have an understanding of burn treatment based on severity
- Recognize signs of infection in a burn patient

F(x) of skin:

★ Epidermis: protection/fluid balance/neuroscience

★ Dermis: protection(elastic & durable), THERMOREG. ★

Complications of burns-loss of skin barrier

- -increased heat loss (hypothermia)
- -increased infection risk
- -wound dessication
- -increased evaporative water loss → fluids!
- -loss of sensation or hyperalgesia
- -loss of skin elasticity

Burn Severity - decides tx plan

★ **Burn depth:** depends on degree of heat & depth penet.

- scalding heat travels FASTER
- 1° factor dictating wound mgmt

★ wound conversion via infx, pressure, poor nutrition

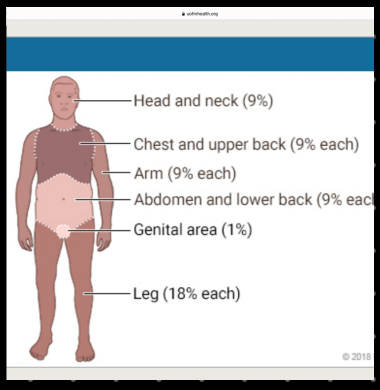
TQ ★ **wound infection:**

★ dont rely on WBC

- ↑ edema
- ↑ sloughing
- softening of subeschar

TQ calculate ★ **rule of 9's**

H/N = 9%.
Chest / upper back = 9% each
arms = 9% each
genitals = 1%
legs = 18% each



Superficial (first degree) = epidermis ONLY, no barrier function alteration

tx: aloe, moisturizers, cool water Ø ICE

Partial thickness (second degree) = epidermis & part of inner dermis (blisters)

tx: elevate, sulfadiazine, moisturize

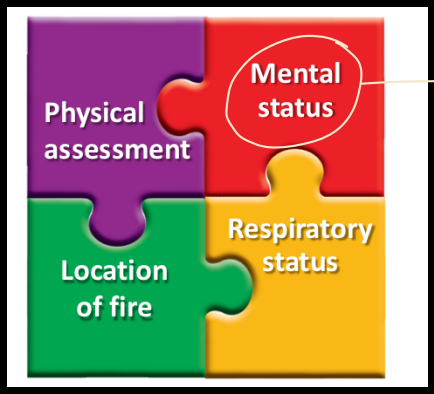
Full Thickness (third degree) = both layers of skin

tx: debride, graft, circumferential = escharotomy
refer to burn center

Subepidermal (4th degree) = both layers & subdermal / tendons & bone involvement

burn center
debride, graft, maybe amputation

LO7 Acute Burn Injuries



→ trumps everything

confused, ↓awake → CO poisoning

Initial Triage:

① remove all clothing
② stop burning process (no ice)
③ prevent hypothermia*

Airway management

- inhalation injury
  - inhalation thermal injury → hoarse voice*
  - CO poisoning → hypoxia/anoxia (found down) → give 100% O_2; ØHBOC for burn patients
  - inhaled chemicals/irritants → px later
- edema d/t ↑capillary permeability + inflammation
  - * >20% = systemic edema → AIRWAY PROBLEM
  - * eschorotomy for ventilation to ↓pressure

TQ

TBSA

* palmar method: pt's palm = 1% TBSA
* indication for fluid resuscitation:
  - [>20% TBSA; >65yo or <2y/o any size] → GIVE LR, large bore IV, ASAP

FORMULAS

prehospital: * Disaster = [% TBSA x 10mL] + 100mL for every 10kg >80kg

TBSA-based:

Parkland

* Parkland = 4mL x kg x % TBSA
* Brooke = 2mL x kg x % TBSA

TQ

Pediatric

* Pediatric = 3mL x kg x % TBSA

→ adjust based on UOP

- too much UOP = ↓ 10%
- too little UOP = ↑10%

* adult UOP = 30-50mL/Hr
  peds UOP = 0.5-1mL/kg/hr

TQ

* Before you get to ER(?)

Initial fluid management

- Initial fluid formula based on age alone
  - -< 5 y/o 125ml/hr of LR
  - -6-14 y/o 250ml/hr of LR
  - -> 15 y/o 500ml/hr of LR

BURNS:

* Tar = thermal injury
  cool tar, remove w/ petroleum based ointment
* Scald = time/temp. of liquid
  160° = instant burn
* Grease (350-375°)
  always full thickness, eschar
* Non-accidental scalds
  Øsplash, clear demarc
* Flash/Flame
  → Flash: Ø full thickness
  → Flame: deep, eschar immediate

TQ

* Chemical burns
  - * [pH >7 → saponification, soupy skin; pH <7 → coag necrosis, tans skin]
  - * Tx: Flush continuously 20 min (unless powder)

Treatment

Sheet Autograft

- Advantages:
  - more durable than mesh grafts
  - more cosmetic
  - contracts less than mesh grafts
- Disadvantages:
  - Bacteria/fluid may collect under the graft causing graft loss.

L08 Complex wound/skin conditions

Congenital Nevomelanocytic Nevus

potentially malignant

large: >2% TBSA or >20cm

tx: surgery after 6mos age

Capillary malformation

= port wine stain

tx: V-beam laser

Hiradenitis Suppurativa

relapsing inflammatory dz of apocrine sweat glands

ABSCESSES @ axillae & inguinal

TQ

tx: Excision & grafting = best outcome

Purpura fulminans

purpuric skin lesion, fever, DIC

TQ

tx:

- neonatal: plasma + anticoag
- idiopathic/infx: Ab + supportive care

Staph Scalded skin syndrome

hx infection, dx of bacterial sepsis

TQ

exfoliative toxin

tx: Ab, Hydration, wound care

Erythema multiforme

SOAPs:

TQ

- Sulfa
- Oral hypoglycemic
- anticonvulsants / antibiotics
- Phenytoin / Penicillin
- NSAIDs

	Erythema Multiforme (EM) Minor/major	Stevens-Johnson Syndrome (SJS)	Toxic epidermal necrolysis (TENS)
History	Fever /malaise/cough Joint pain	Fever/malaise	Fever/malaise
Mucosal involvement	Minor: no involvement Major: one or more	Yes	Yes
Skin slough	Minor: localized eruption. Target shaped lesions Major: lesions slough < 10%	< 10% TBSA	> 30% TBSA
Duration	1-4 weeks. Reoccurrence expected	1-6 weeks	1-6 weeks
Mortality	> 5%	0-40%	25-80%
Cause	Most cases bacterial/viral 55% cases caused by HSV	Rxn to foreign agent	Drugs implicated 77-94% of cases

Treatment

- Wound care
- Enteral feeds due to oral lesions
- Foley catheter due to penile ulcerations
- Eye lubricants for protection
- Anxiety and pain control