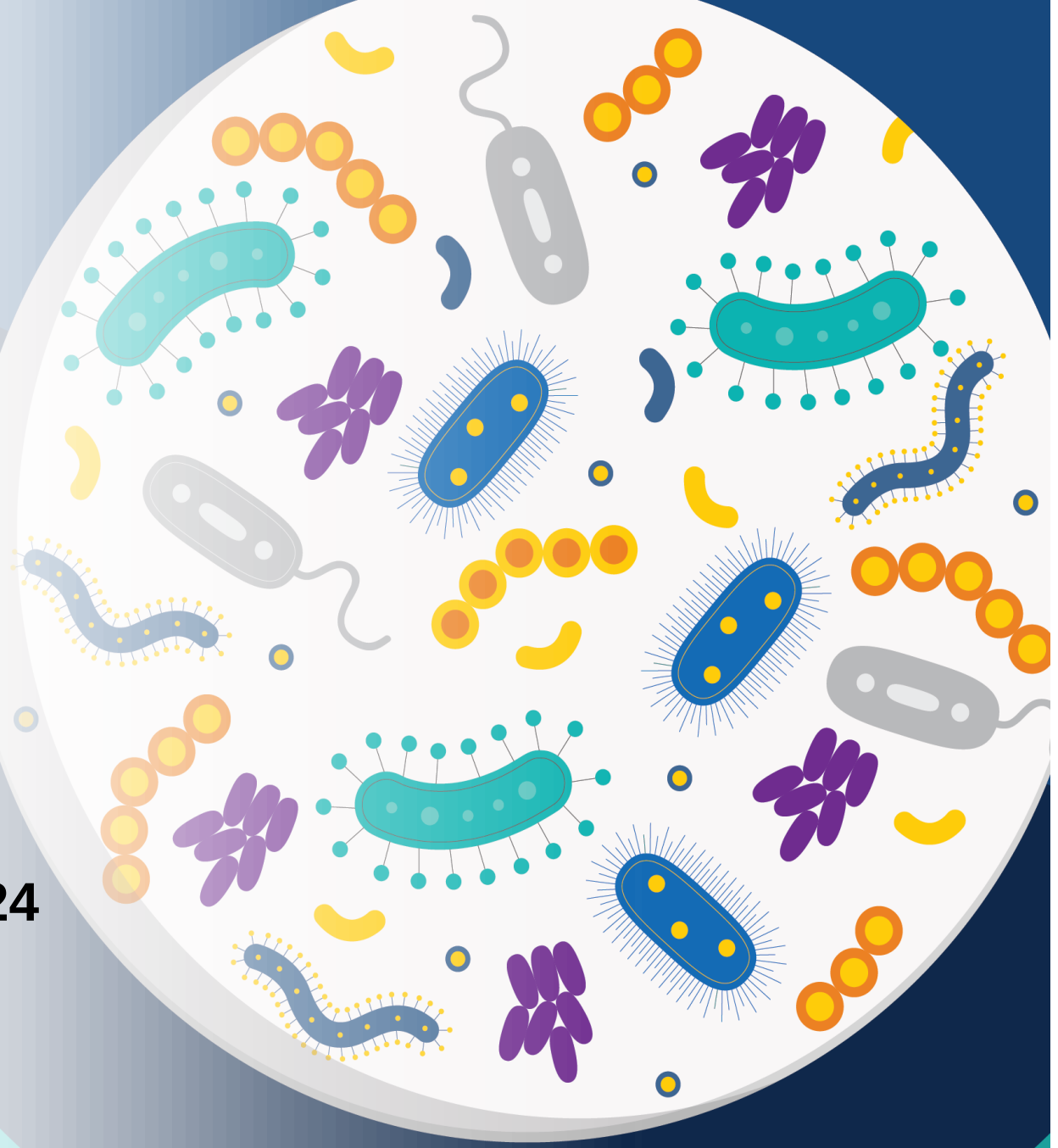
Bacteria, Fungus, or Virus?

An Update on Infections of the Skin



Skin, Bones, Hearts, and Private Parts 2024

Kara N. Roman, MMS, PA-C

Associate Director & Assistant Professor

George Fox University PA Program

Disclosures and Images

- No conflicts to disclose
- Images – all images obtained and used within the guidelines provided from DermNetNZ.org unless otherwise attributed
- Reproduction or copying of content or images prohibited
- Thank you

Learning Objectives:

- Distinguish between the various types of bacterial, viral, and fungal skin and soft tissue infections utilizing a patient's clinical presentation and risk factors
- Develop a plan to manage common skin infectious using appropriate medications and diagnostic/therapeutic procedures
- Discuss prevention measures for skin and soft tissue infections where appropriate
- Identify the dermatologic emergencies often precipitated by infection or hypersensitivity reactions

12-year-old male presents for evaluation of the following skin lesions.

- 4-week duration
- Non-pruritic
- Coincided with summer sports activities and increased perspiration
- No other family members with rash
- No recent travel or exposure to pets

Image source: https://adc.bmj.com/content/96/4/392

Pityriasis Versicolor – Diagnostic Pearls

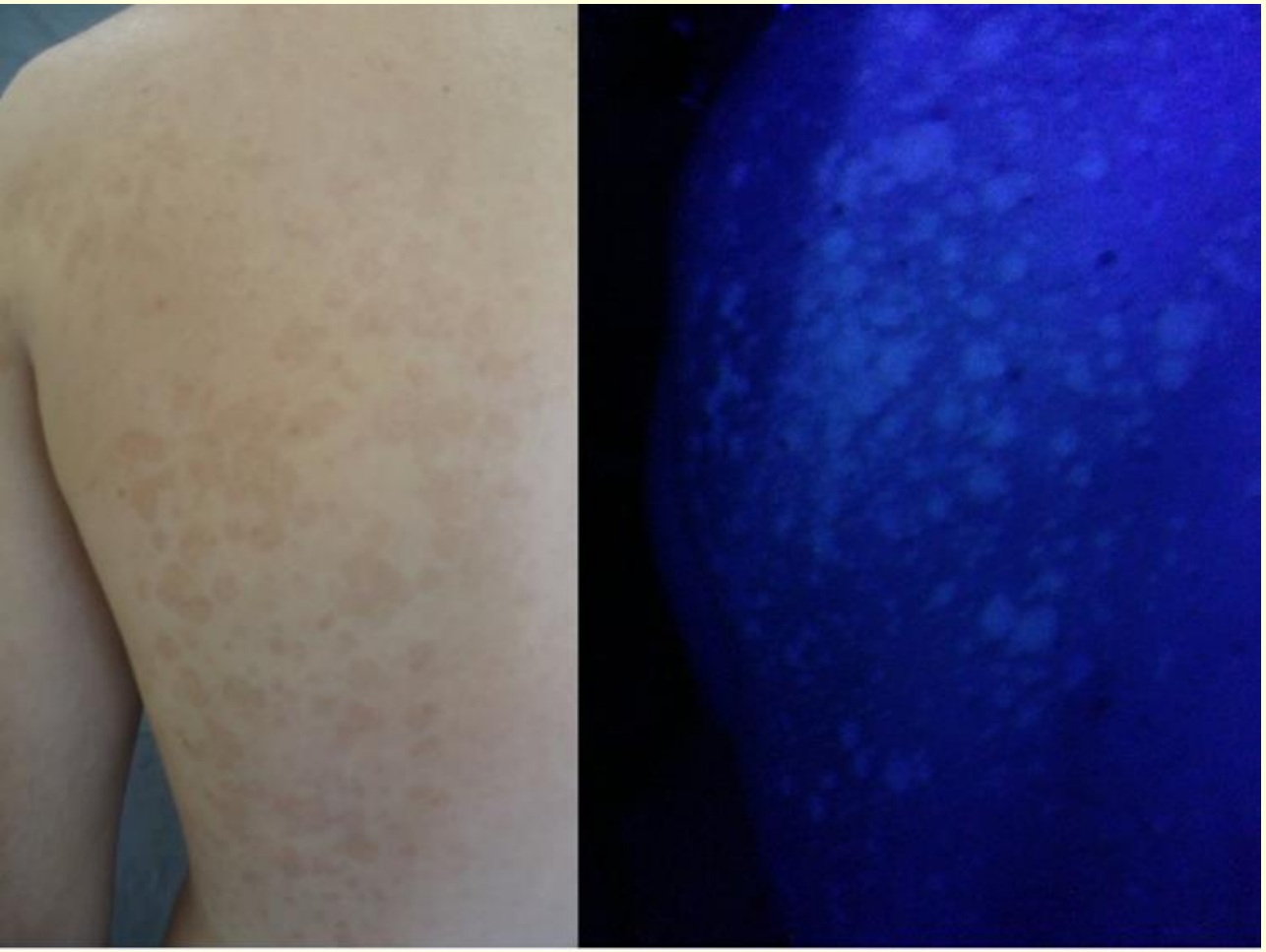
- Superficial fungal infection caused by *Malassezia* species of yeast in stratum corneum
- Flourishes in hot and humid environments
- Increased sebum production facilitates growth

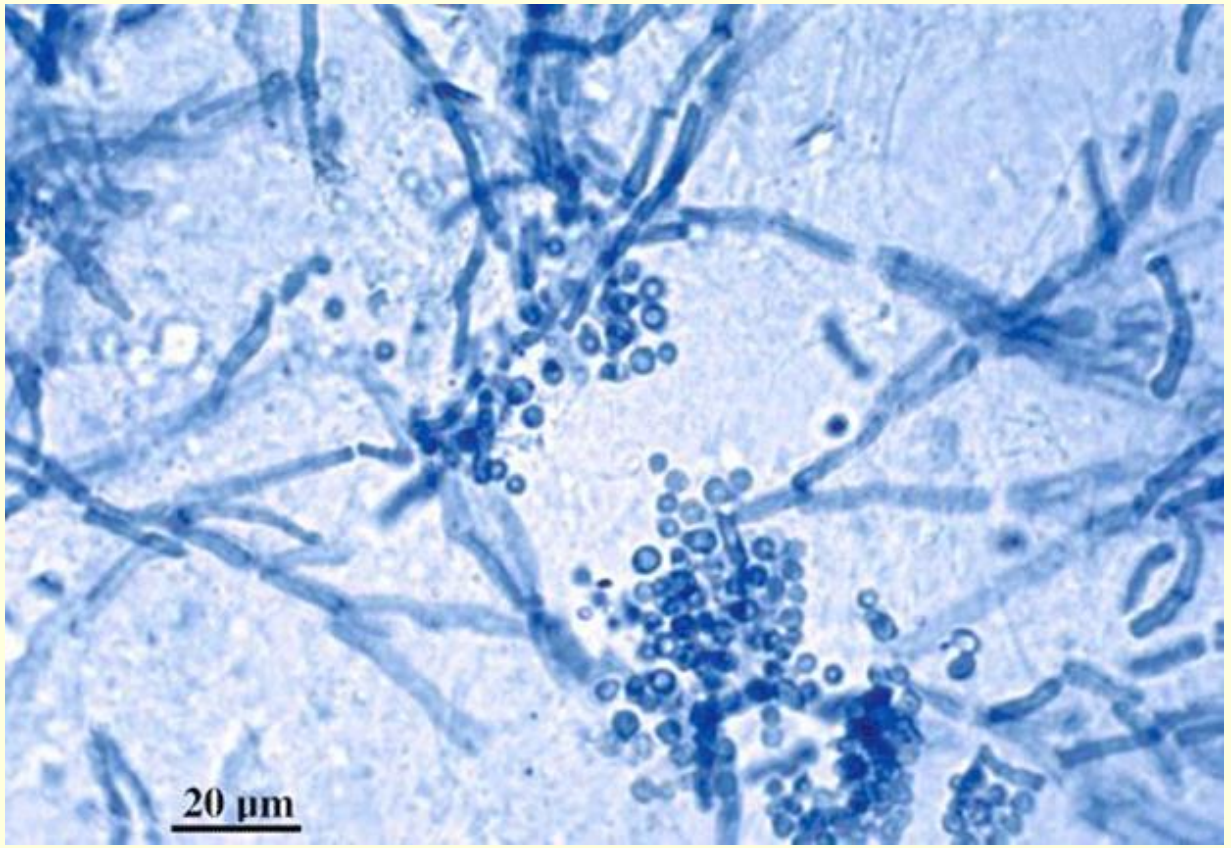
- Hyper or hypo pigmented circles or ovals with fine scale
  - Evoked scale sign
- Trunk, neck and upper arms
- KOH
  - Sticks and stones
  - Spaghetti and meatballs
- Wood's light
  - Greenish-yellow fluorescence

After Stretch

Vivian S Shi, and Peter A Lio Arch Dis Child 2011;96:392-393

ADC





https://www.researchgate.net/figure/Patients-dorsum-with-pityriasis-versicolor-caused-by-Malassezia-fur-fur-with_fig3_323228320
https://step1.medbullets.com/dermatology/112070/tinea-versicolor

Pityriasis Versicolor – Treatment

- Topical treatments effective and well-tolerated
  - Shampoos and lotions – apply to affected area for 5-10 minutes then wash off, twice a day for 7-14 days, then once a month
    - Zinc pyrithione
    - Selenium sulfide
    - Ketaconazole
- May take considerable time and maintenance
- Recalcitrant or recurring consider oral therapy
  - Fluconazole 300 mg weekly for 2-4 weeks
  - NOT terbinafine
  - NOT ketaconazole

Patient presents for evaluation of the following skin lesions.

How would you describe them in the medical record?

Image source: https://dermnetnz.org/

Impetigo/Ecthyma – Diagnostic Pearls

- **Impetigo** – highly contagious superficial skin infection primarily caused by – *S. aureus* (1-10% CA-MRSA)
- Lesions begin as vesicles or pustules that quickly transition to erosions with crusting, small inflammatory halos
- Face and extremities most common sites
- Mild LAD, no systemic symptoms

- **Ecthyma** – deeper dermal pyoderma
- Lesions are typically tender, edematous and heal with scarring
- LAD and systemic symptoms present
- Diagnostic testing – Gram stain, culture – recommended by IDSA 2014
- Typical cases – empiric treatment

Impetigo/Ecthyma – Treatment

- Practice Guidelines for Diagnosis and Management of Skin and Soft Tissue Infections: 2014 Update by IDSA https://www.idsociety.org/practice-guideline/skin-and-soft-tissue-infections/
- Topical treatment for limited impetigo
  - Mupirocin, Retapamulin – BID for 5 days
  - Soak to remove crust
- Oral for numerous impetigo, in outbreaks, and for all ecthyma
  - CA-MRSA – Doxycycline, Clindamycin, TMP/SMX – 7 days
  - MSSA - Dicloxacillin, Cephalexin – 7 days

Patient presents for evaluation of the following skin lesions.

How would you describe them if you were calling a consult to the provider sitting next to you?

What descriptions did you hear?

HPV – Diagnostic Pearls

- HPV 1, 2, 3, 4, 10, 27, 57
- Most common in children and young adults (nearly 50% affected), increasingly seen in patients with atopic dermatitis and decreased cell-mediated immunity
- Types – verruca vulgaris, plantaris, plana, filiform
- Clinical diagnosis
  - Thrombosed capillaries
  - Altered dermatoglyphics

HPV – Treatment

- Spontaneous remission in 50% by 1 year, 2/3 of patients in 2 years, especially children
- Treatment indicated
  - Pain/discomfort, functional impairment
  - Concern for cosmesis or social stigma
  - Persistent warts
  - Immunosuppression

HPV- Treatment

- Chemical or physical destruction
  - Salicylic acid – irritation and exfoliation, paints or plasters, applied daily after paring with occlusion for 3-4 months
  - Cryotherapy – every 2-3 weeks for 3 months, keep wart frozen for 15-30s
  - Combo of both
- Enhancement of local immune response
  - Imiquimod
  - Contact or intralesional immunotherapy
- Antiproliferative therapy
  - 5-FU
  - Bleomycin
  - **Tretinoin –might be preferred for verruca planus**

An Option for Recalcitrant and Extensive Warts?

- Intralesional or intramuscular HPV vaccine
  - Nofal A et al. Intralesional versus intramuscular bivalent human papillomavirus vaccine in the treatment of recalcitrant common warts, J Am Acad Dermatol vol 82, No 1, July 2019.
  - Waldman, Abigail MD; Whiting, Dennis PA-C; Rani, Monica MD; Alam, Murad MD, MSCI, MBA, HPV Vaccine for Treatment of Recalcitrant Cutaneous Warts in Adults A Retrospective Cohort Study. Dermatologic Surgery: December 2019 - Volume 45 - Issue 12 - p 1739–1741

Patient presents for evaluation of the following skin lesion.

It is warm and tender.

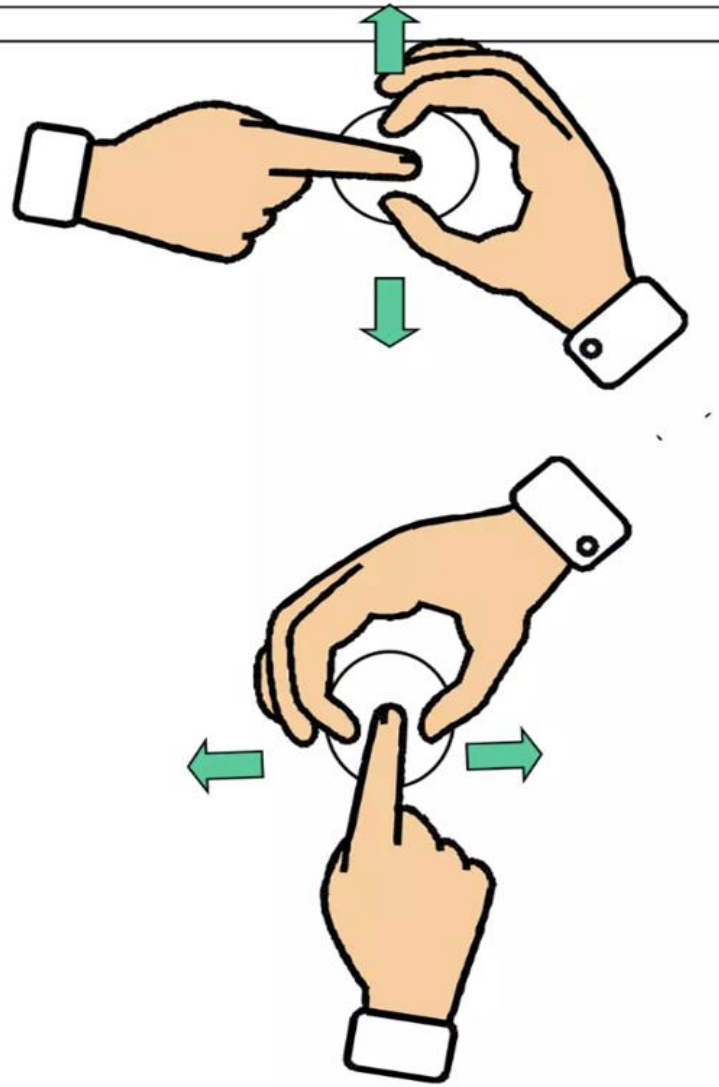
Image source: https://dermnetnz.org/

Purulent Infections – Diagnostic Pearls

- Folliculitis – single follicle
- Furuncle – deeper, yet still one follicle
- Carbuncle – larger, often with fever, LAD, fatigue
- Gram stain and culture are ideal
- Mild, moderate, severe classifications

- Most purulent infections = *Staphylococcus aureus (MSSA and MRSA)*

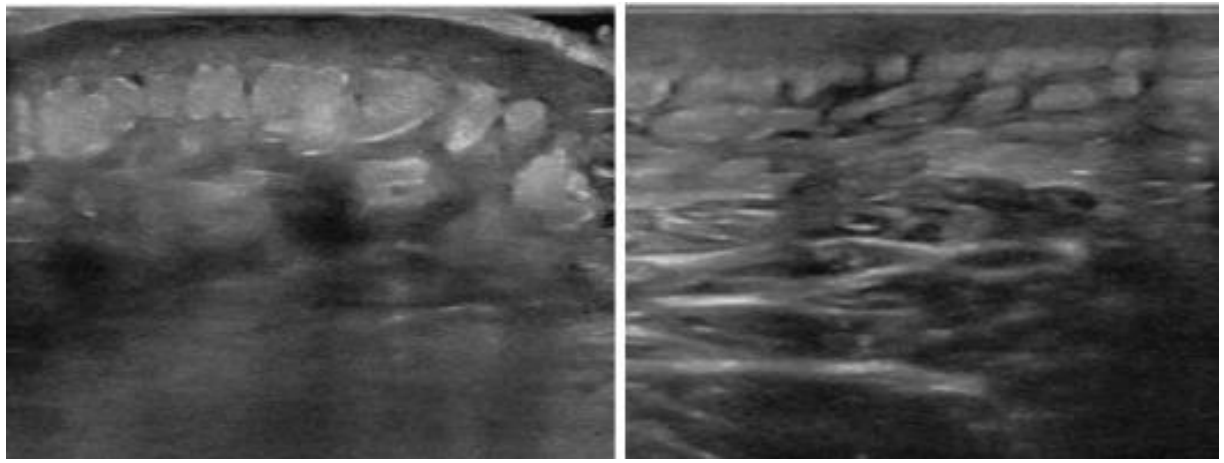
Fluctuant or non-fluctuant

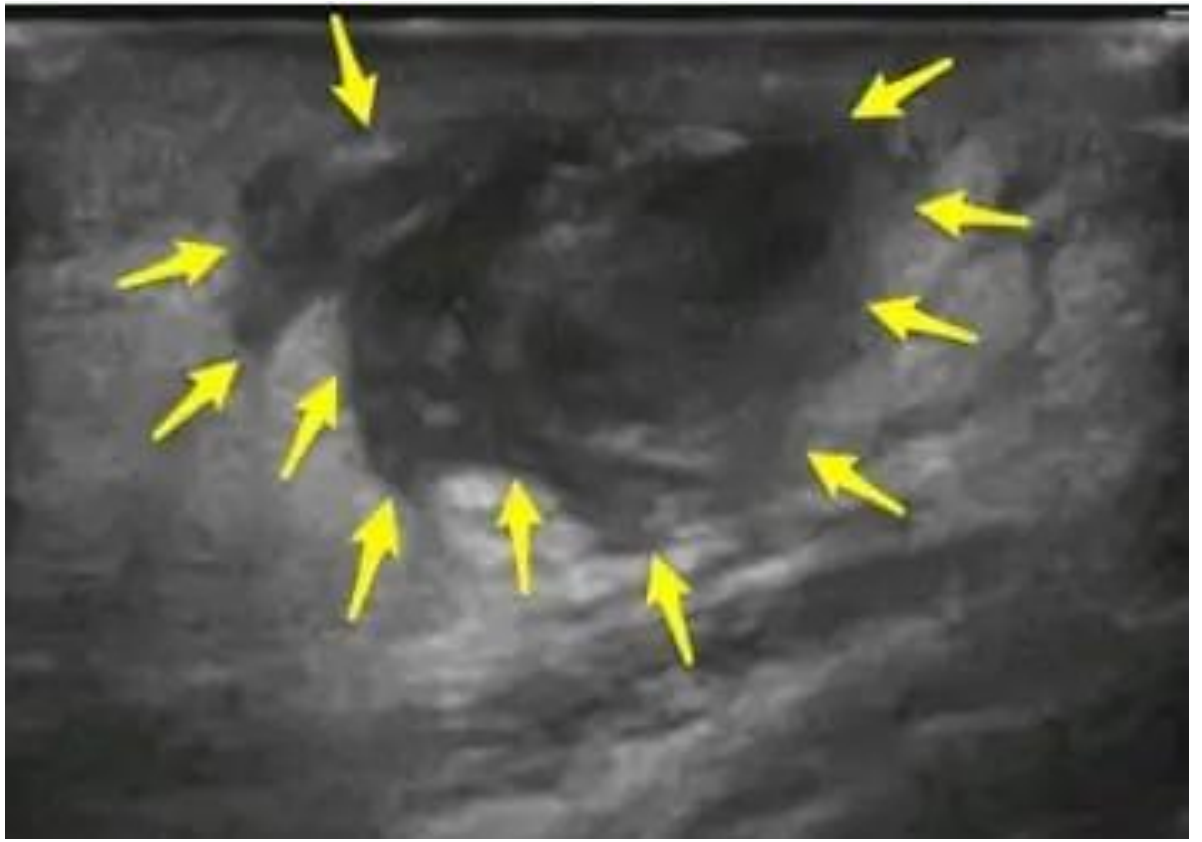


- Two digits are placed either side of the apex of the swelling
- Pressure is applied to the apex
- This is repeated with the digits at 90°
- The finding is positive if the two digits are pushed away in both directions
- If a swelling is fluctuant, it suggests the presence of fluid within the swelling.

POCUS – Point of Care US

- Barbic *et al.* 96.2% sensitivity and 82.9% specificity for detecting abscess
- Cobblestones – hyperechoic lobules of subcutaneous fat surrounded by relatively hypoechoic inflammatory fluid (cellulitis)
- Purulent Fluid Collection – rounded shape of anechoic or hypoechoic fluid collection with surrounding cobblestones and no color flow on doppler





Barbic, D., Chenkin, J., Cho, D., Jelic, T., & Scheuermeyer, F. (2017). BMJ Open, 7(1), E013688.

Purulent Infections – Treatment

- Incision and Drainage
  - Warm, moist compresses
- Add on oral or parenteral antibiotics

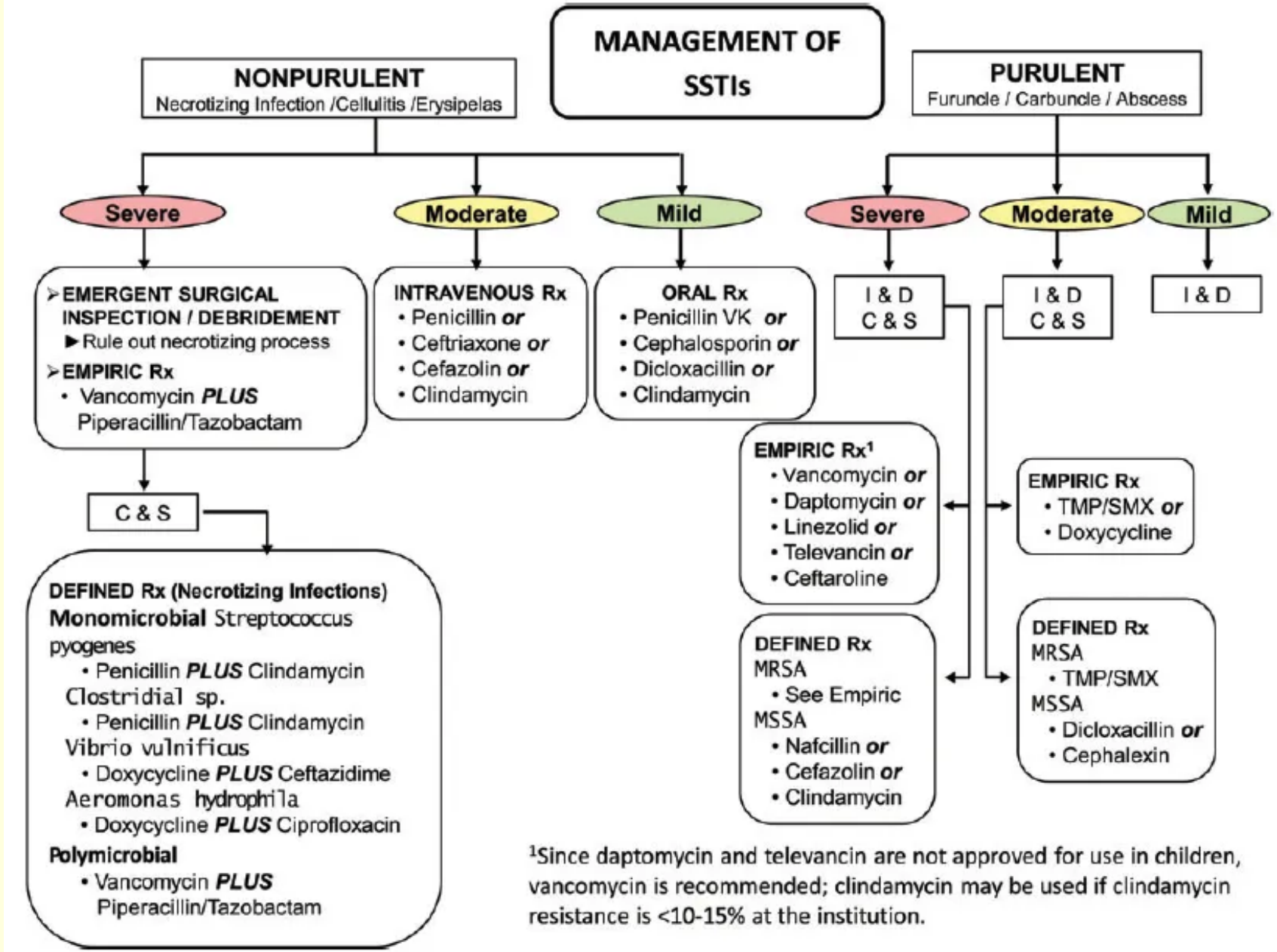
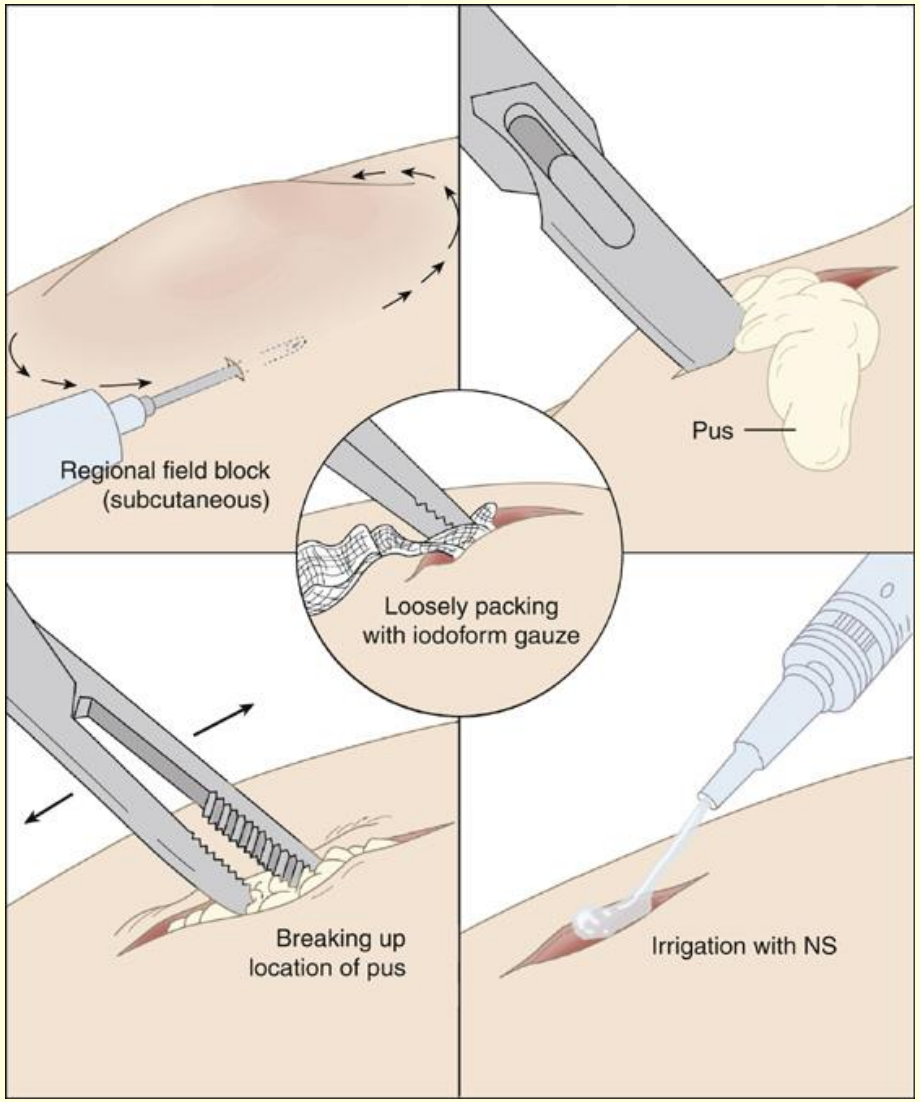
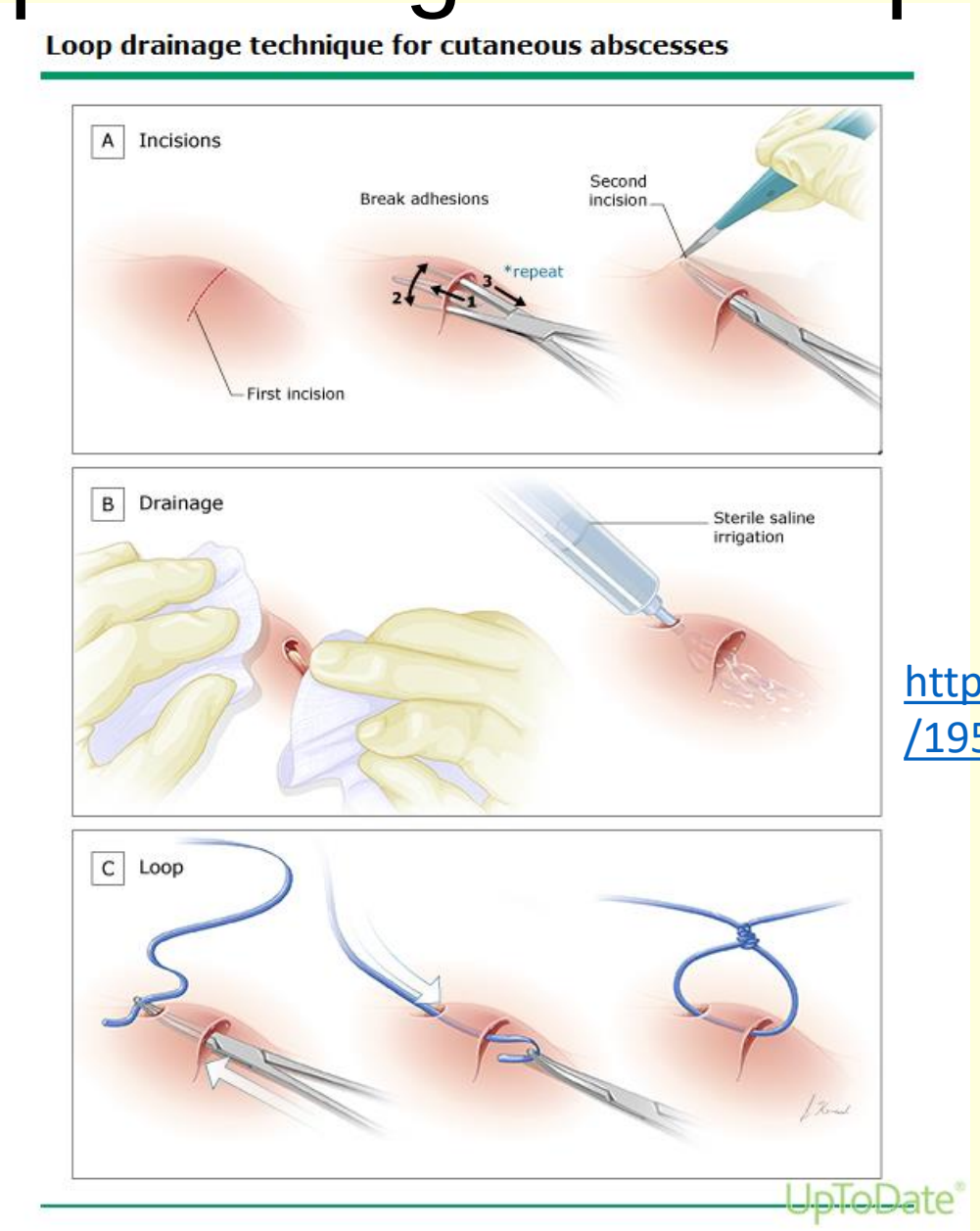


Image source: https://www.idsociety.org/globalassets/idsa/practice-guidelines/practice-guidelines-for-the-diagnosis-and-management-of-skin-and-soft-tissue-infections-2014-update-by-the-infectious-diseases-society-of-america.pdf

Traditional I&D and Loop Drainage Technique



https://aneskey.com/cutaneous-abscess-or-pustule/



https://vimeo.com/19580472

Addition of Antibiotics in Purulent Skin Infections per IDSA 2014

- Temp > 38 degrees C or < 36 degrees C
- Tachypnea > 24/min
- Tachycardia > 90 bpm
- WBC > 12,000 or < 4,000

- Immunosuppression
- Hypotension

Guidelines vs Actual Management of Skin and Soft Tissue Infections in the ED

Kamath RS, et al. OFID 2017

- 214 cases of SSTI in ED retrospectively analyzed at Michael E. DeBakey Veterans Affairs Medical Center, Houston

- Total number that were managed in accordance with IDSA 2014 guidelines in all 4 categories (site of treatment, choice of antibiotic, I&D of abscess, ordering cultures)

43/214 = 20.1%

Systemic Antibiotics – New Data

Gottlieb, M et at. A Systematic Review and Meta-Analysis. Annals of Emergency Medicine Vol 73, No 1, January 2019.

- All randomized controlled trials comparing systemic antibiotics (MRSA coverage) vs placebo in the treatment of skin abscesses after I&D
- 4 studies, 16 clinical sites in US, ED and one outpt setting = 2,406 patients (4-44 yo)
- Most used TMP/SMZ, one used clindamycin
- Overall cure rate for abscesses after I&D was high in both groups
- Nearly 2-fold improvement in cure rates and a NNT of 14 for antibiotic groups
  - Reduced number of return visits and need for painful repeat I&D, return to work sooner, decreased incidence of new lesions, decreased rate of infections in household members

To Pack or Not to Pack

NO

- 5 cm or less
- Immunocompetent pt
- Less pain
- No change in cure rate
- No change in secondary interventions

Maybe or YES

- Larger abscesses
- Consider the area
- Immunocompromised pts have not been studied

Source: List M et al. Treatment of Skin Abscesses: A Review of Wound Packing and Post-Procedural Antibiotics. South Dakota Medicine, March 2016.

Recurrent Skin Abscesses

- Consider 5-day decolonization regimen:
  - Twice daily intranasal mupirocin
  - Daily chlorhexidine washes
  - Daily decontamination of personal items such as towels, sheets, and cloths for recurrent *S. aureus*
- Evaluate adult patients for neutrophil disorder if recurrent abscesses began in childhood
- Search for local causes – pilonidal cyst, hidradenitis suppurativa, foreign body

Patient presents for evaluation of the following skin lesions.

https://dermnetnz.org/

Onychomycosis – Diagnostic Pearls

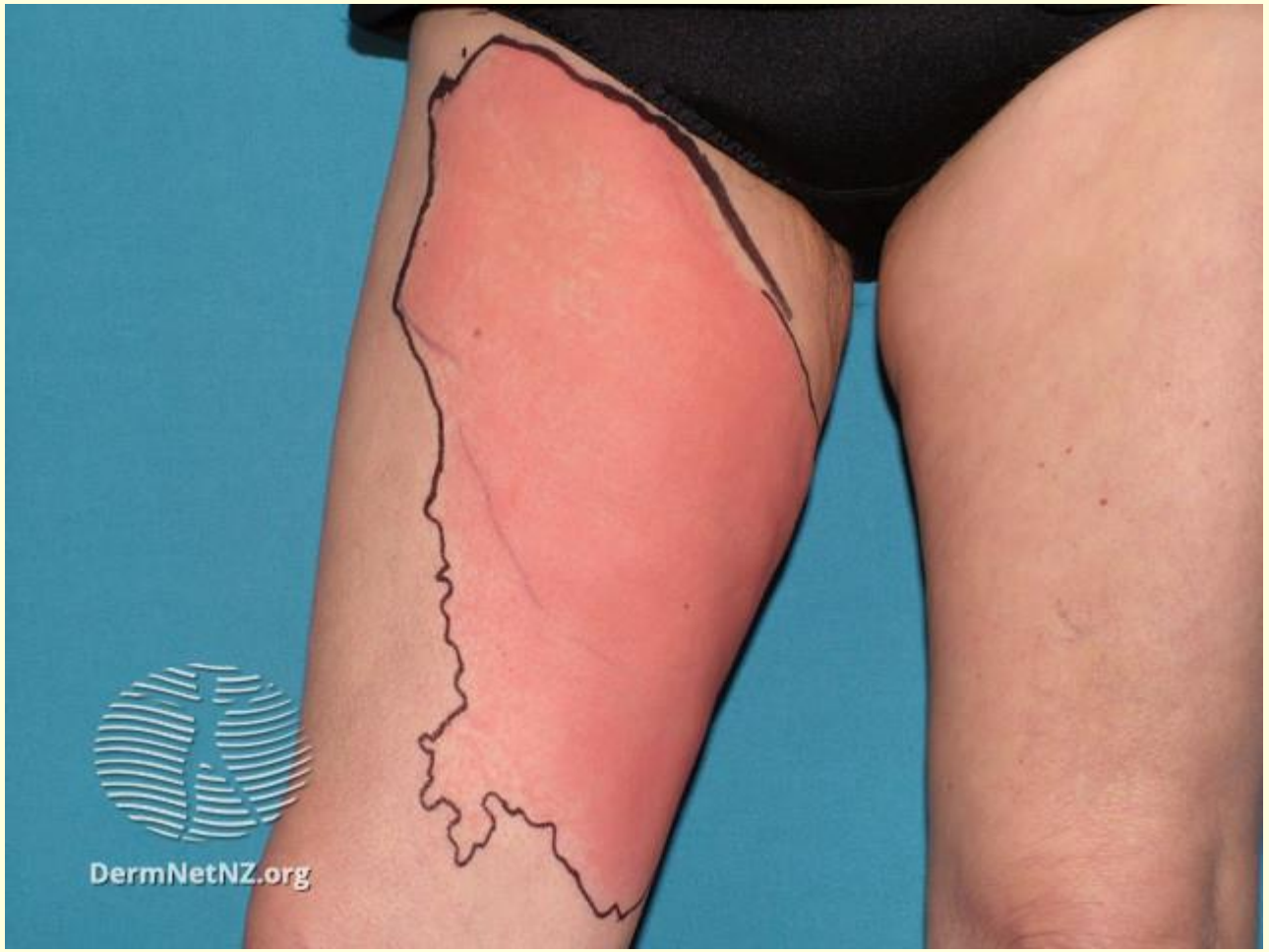
- Most often occurs in adults
  - Nail injury increases risk
  - Present amongst family members due to autosomal inheritance (HLA-DR8)
- *T. rubrum* most frequent dermatophyte
- Common clinical manifestations
  - Nail discoloration
  - Subungual hyperkeratosis
  - Onycholysis
  - Nail plate splitting and destruction
- Diagnostic testing
  - KOH - screen
  - Fungal culture & PCR – identify the organism before treatment

Onychomycosis – Treatment

- Mild to moderate disease (<50% nail involvement) with no matrix involvement
  - Ciclopirox
  - Efinaconazole
  - Tavaborole
- Established and severe disease
  - Terbinafine – preferred
    - 250 mg orally once a day for 6 weeks for fingernails and 12 weeks for toenails
    - Measure transaminases (and maybe CBC) before initiating therapy, no repeat testing in healthy <65 yo pts
  - Itraconazole
    - 200 mg per day for 12 weeks for toenails
    - 200 mg twice a day for 1 week with second “pulse” 3 weeks later for fingernails

Devices to Treat Nail Fungus

- Laser
- Drilling
- Photodynamic therapy
- Plasma therapy



A patient presents for evaluation of the following skin lesions.

Image source: https://dermnetnz.org/

Cellulitis/Erysipelas – Diagnostic Pearls

- Erysipelas – bright red, more superficial, raised border, well-demarcated margin, preceded by flu-like symptoms, burning at site
- Cellulitis – deeper location to subcutaneous tissues, non-elevated, poorly defined margins,
- Usually caused by *Streptococcus* A, B, C, G
- Bedside ultrasound best option for differentiating abscess from cellulitis

Cellulitis/Erysipelas – Treatment

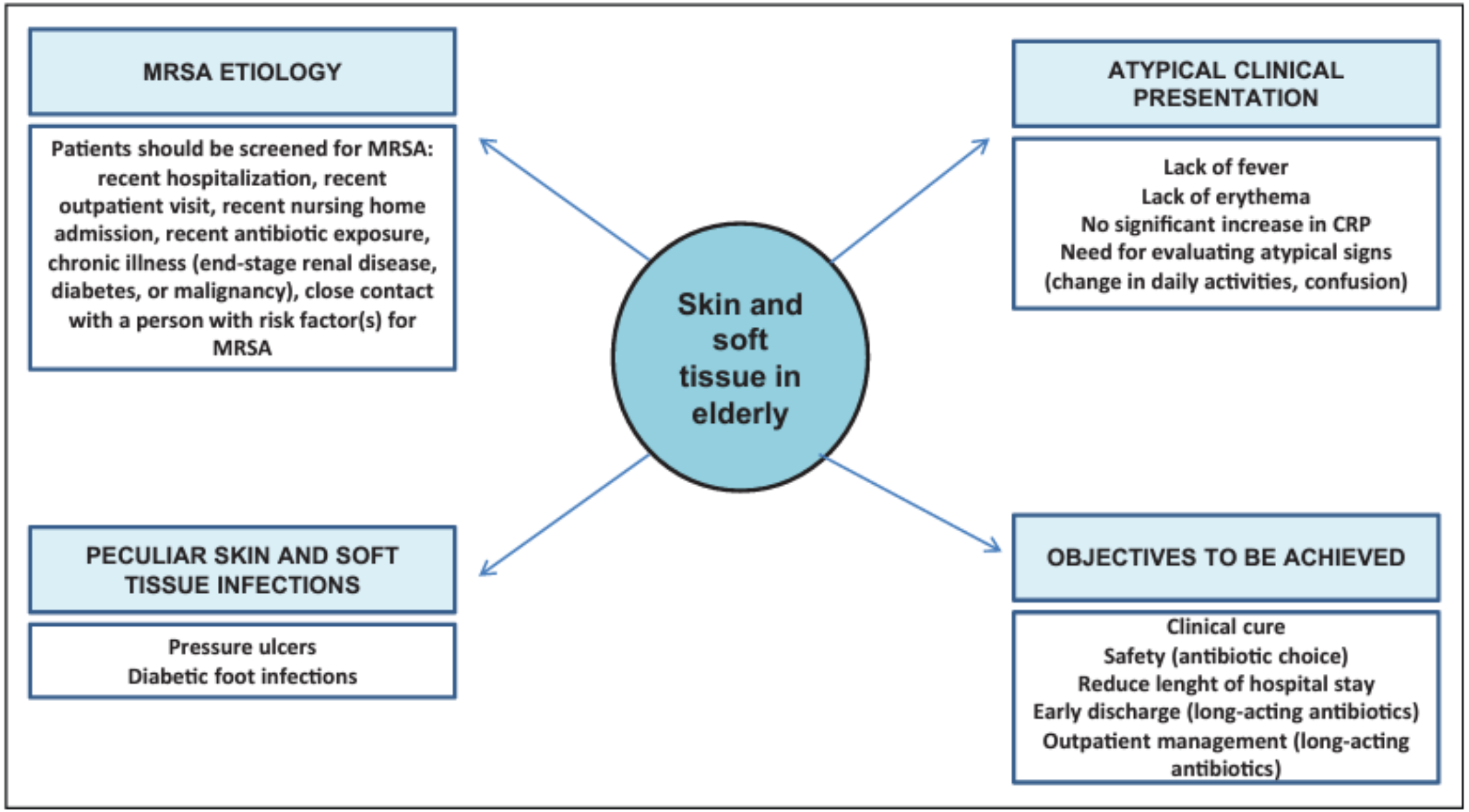
- Mild and typical with no evidence of purulence or trauma
  - Oral dicloxacllin, cephalexin, clindamycin for 5 days
- Moderate infections with systemic signs
  - IV ceftriaxone, clindamycin, cefazolin, penicillin
- Severe
  - Vancomycin plus piperacillin-tazobactam or imipenem
  - Additional corticosteroids
    - Prednisone 40 mg daily for 7 days
- Immobilization and elevation
- Treat tinea pedis
- Watch for worsening
  - Consider marking borders
- MRSA more likely
  - Penetrating trauma
  - Illicit drug use
  - Known nasal colonization
  - Purulent drainage
- MRSA = Vancomycin

Recurrent Cellulitis

- Risk factors
  - Tinea pedis
  - Obesity
  - Venous insufficiency
  - Lymphedema
- Prophylactic abx if 3-4 episodes per year despite treating predisposing factors
  - Pen VK or erythromycin orally twice daily for 4-52 weeks

Risk for Atypical Organisms

- Immunosuppression
- Animal or human bites
- Sea or freshwater exposure to broken skin
- Exposure to animals, fish, or reptiles
- IVD use



Falcone M, Tiseo G. Skin and soft tissue infections in the elderly. Curr Opin Infect Dis. 2023 Apr 1;36(2):102-108. doi: 10.1097/QCO.0000000000000907. Epub 2023 Jan 25. PMID: 36718942; PMCID: PMC10325572.

Cat/Dog Bites – Identify pts at high risk

- Immunocompromised
- Asplenic
- Advanced liver disease
- Pre-existing or resultant edema of the affected area
- Moderate to severe injuries, especially to hand or face
- Injuries that penetrate the periosteum or joint capsule
- Deep puncture wounds

- 3-5 days of preemptive therapy
- Augmentin 875 mg twice daily
- Alternatives
  - Cefuroxime plus clindamycin/metronidazole
  - Imipenem/meropenem
  - Moxifloxacin
  - Doxycycline

Characteristics of Necrotizing Infections

- Pain out of proportion to examination or tenderness beyond area of erythema
- Bullae
- Crepitus
- Cellulitis refractory to antibiotic therapy or rapidly progressing
- Dusky appearance of skin
- Systemic toxicity
- Low serum sodium (<135 mmmol/l)
- WBC > 15,400 cell/ml
- Renal failure
- Progressive lactic acidosis

14-year-old male presents for evaluation of red circular rash on his body that he noticed after soccer practice yesterday

- Pt states he doesn't feel sick, but the rash might be a little itchy
- He is unaware of any family or friends that are ill or have rashes
- The soccer coach will not let him play or practice until he gets "checked out"

Image source: https://dermnetnz.org/

Pityriasis Rosea – Diagnostic Pearls

- Self-limiting skin condition
- Reactivation of HHV-6/7
- Typically presents in 10-35-year-old pts
- Herald patch appears first on truck in cases (lasts for 2 weeks in isolation)
- Prodromal symptoms – malaise, nausea, headache, URI, concentration difficulty, ST, body aching
- Secondary eruption on trunk in Langer lines and to proximal extremities (lasts for up to 12 weeks)
- All lesions have scaling and are typically pruritic
- Some medications associated with PR-like eruption – ACEI, NSAID

Image source: https://dermnetnz.org/topics/pityriasis-rosea-images/

PR – Treatment

- Self-limited = watchful waiting, patience
- Treat options
  - Oral antihistamines
  - Oral or topical corticosteroids
  - Acyclovir (maybe)
  - Phototherapy also hastens resolution
- No benefit to macrolides

Patient presents for evaluation of the following skin lesions.

Image source: https://dermnetnz.org/

Molluscum Contagiosum – Diagnostic Pearls

- Benign, self-limited disease
- Caused by a pox virus
- Most common ages 1-4
- More common in pts with atopic dermatitis and with swimming
- In adolescents and adults, consider STIs and immunocompromised states

- Clinical diagnosis
  - Small, firm, pearly papules with a central depression
  - Core may be expressed, producing a white cheesy material
  - The lesions average 2 to 5 mm in size and are usually painless, but may become inflamed, red, and swollen
  - Distribution typically face, truck, limbs

MCV – Treatment

- Treatment is for cosmesis and to prevent spreading
- Destructive therapies most common
  - Curettage – most successful, least number of visits, greatest parent satisfaction
  - Cantharidin
  - Cryotherapy
- Patience
  - 50% completely resolved 1 year
  - 70% at 18 months
  - BOTE sign “Beginning of the end”
    - Clinical erythema and swelling of the lesion when regression phase begins
- Other therapies not proven superior to destructive therapies
  - Imiquimod
  - KOH
  - Salicylic acid
  - Retinoids

https://childhood101.com/kids-health-molluscum-contagiosum/

https://dermnetnz.org/topics/cantharidin/

https://ars.els-cdn.com/content/image/1-s2.0-S0190962213004106-gr1_lrg.jpg

https://www.dermatologytimes.com/article/verrica-develops-solution-common-warts

Verrica develops a solution for MC, common warts and genital warts

Del Rosso JQ, Kircik L. Topical Cantharidin in the Management of Molluscum Contagiosum: Preliminary Assessment of an Ether-free, Pharmaceutical-grade Formulation. *J Clin Aesthet Dermatol*. 2019;12(2):27–30.

Source: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6415708/

6-year-old male presents for evaluation of this pruritic eczematous rash on his torso

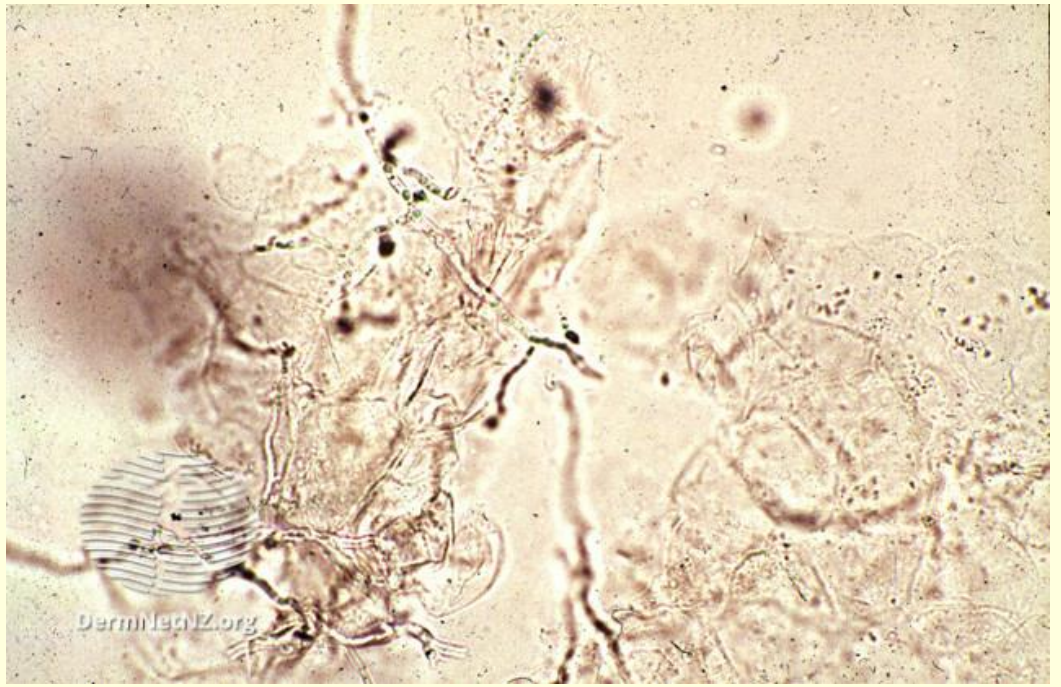
- It developed over the past week as an initial small circular lesion that has spread

http://www.crestingthehill.com.au/2015_04_01_archive.html
http://advancedskinmd.com/tinea-corporis-ringworm/

Tinea Corporis – Diagnostic Pearls

- Usually presents as annular, scaly plaques
- At risk groups
  - Contact sports
  - Domestic animal contact
  - Warm, humid climates
  - DM, immunodeficiency
- Typical organisms
  - *M. canis*
  - *T. rubrum, mentagrophytes, tonsurans*

- Diagnostic options
  - KOH
  - Wood's lamp
  - Culture
  - Biopsy



Tinea Corporis – Treatment

- Topical antifungals
  - Azoles
    - Econazole
    - Oxiconazole – comes in a lotion form for more hairy areas
  - Allylamines
    - Terbinafine
    - Naftifine
- Oral antifungals
  - Terbinafine
  - Itraconazole

- Twice a day application of topicals for 4-6 weeks generally
- Keep skin cool and dry
- Avoid combination products with steroids and antifungals
- Topical nail lacquers modestly effective
  - Efinaconazole
  - Tavaborole

Majocchi’s granuloma

- Perifollicular lesions
- *T. rubrum, T. mentagrophytes*
- Systemic therapy needed

Image source: https://dermnetnz.org/topics/majocchi-granuloma/

Bacteria, Virus, or Fungus? Let’s Review

Bacterial Infections

- Impetigo/Ecthyma
- Furuncle/Carbuncle/Abscess
- Cellulitis/Erysipelas

- Staphylococcal scalded skin/Scarlet fever/TSS
- Lyme
- Secondary syphilis
- Erythrasma

- Infectious Diseases Society of America (IDSA). Guidelines for skin and soft tissue infections, 2014. https://www.idsociety.org/practice-guideline/skin-and-soft-tissue-infections/

Viral Infections

- HPV
- Molluscum
- Viral exanthems
  - Erythema infectiousum
  - Roseola
  - Herpangina/HFM
  - Pityriasis rosea

- Herpes
  - Simplex
  - Zoster

Fungal Infections

- Dermatophytoses
  - Tinea corporis
  - Onychomycosis
- Pityriasis versicolor

- Candidiasis
- Majocchi granuloma
  (Pronunciation: mah-yok’ē)
- Sporotrichosis

Dermatologic “Must-Not-Misses” Often Related to Infection, Hypersensitivity Reactions

When you must think quickly

Clues to Life-Threatening Rashes

- Mucous membrane involvement
- Extensive blisters or peeling of skin
- Extensive erythema and fever
- Pain out of proportion to exam
- Altered LOC
- Petechial or purpuric lesions

Generalized Rashes That Could Be Life-Threatening

- Infectious
  - RMSF
  - Meningococcemia
  - Toxic Shock Syndrome/SSSS
  - Necrotizing fasciitis
- Hypersensitivity Reactions
  - Type I: Urticaria, angioedema, anaphylaxis
  - Steven-Johnson syndrome
  - Toxic epidermal necrolysis

RMSF

Rocky Mountain Spotted Fever

Image source: DermNetNZ.org

Image source: https://www.cdc.gov/rmsf/training/hcp/html/images/rashpetechialhand_galvarezcrop_image57076.png

Meningococcemia

http://aapredbook.aappublications.org/cgi/powerpoint/aapredbook;2006/1/3.76/080_10

Meningococcemia

TSS/SSSS

TSS/SSSS

Necrotizing Fasciitis

Necrotizing Fasciitis

Steven-Johnson Syndrome

Erythema Multiforme

http://www.emedicinehealth.com/script/main/art.asp?articlekey=110051

Toxic Epidermal Necrolysis

Selected References/Resources

- Practice Guidelines for Diagnosis and Management of Skin and Soft Tissue Infections: 2014 Update by IDSA https://www.idsociety.org/practice-guideline/skin-and-soft-tissue-infections/
- Gupta, AK, et al. Fungal Skin Infections. *Pediatrics in Review* 2017;38;8.
- Lipner, SR, Scher, RK, Onychomycosis Treatment and Prevention of Recurrence, *J Am Acad Dermatol*, Vol 80, No 4, April 2019.
- Rush, J, Dinulos, JG, Childhood skin and soft tissue infections: new discoveries and guidelines regarding the management of bacterial soft tissue infections, molluscum contagiosum, and warts, *Curr Opin Pediatr* 201, 28:250-257.
- Ibrahim, F, Khan R, Pujalte, GA, Bacterial Skin Infections, *Prim Care Clin Office Pract* 42 (2015) 485-499.