

Introduction to skin and soft tissue:

Colonisation and Infection



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Normal skin

- First line of immune system defence
- Normal skin microbiome depends on environmental exposure and conditions
- Common skin bacteria
 - Staphylococcus species (Gram= GPC)
 - Staph aureus (1/3 population), Staph epidermidis, Staph capitis, Staph hominis and MANY MORE
 - Corynebacterium (Gram= GPR)
 - Cutibacterium acnes (Gram= GPR)
- Site-specific colonisation e.g. perianal/groin = gut bacteria found on skin e.g. *E. coli*



What is the difference between colonisation and infection?

- Colonisation = bacteria present (can be confirmed using culture of skin swab)
- Infection = bacteria invade to cause symptoms and signs...

What is the difference between colonisation and infection? QUESTIONS – skin infection

- What are the symptoms a patient may experience?
- What would the signs be on clinical examination?

Signs of wound infection

- Redness
- Heat
- Pain
- Swelling
- Exudate (purulent, serous, or serosanguinous)
- Odour
- Poor healing
- Contact bleeding
- Epithelial bridging
- Tissue breakdown
- Presence of unhealthy granulation tissue
- Systemic illness in the absence of other focus of infection





Impetigo. Usual
cause:
***Staphylococcus
aureus***



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Erysipelas of the leg



Erysipelas of the lower leg. The rash is intensely red, sharply demarcated, swollen, and indurated.

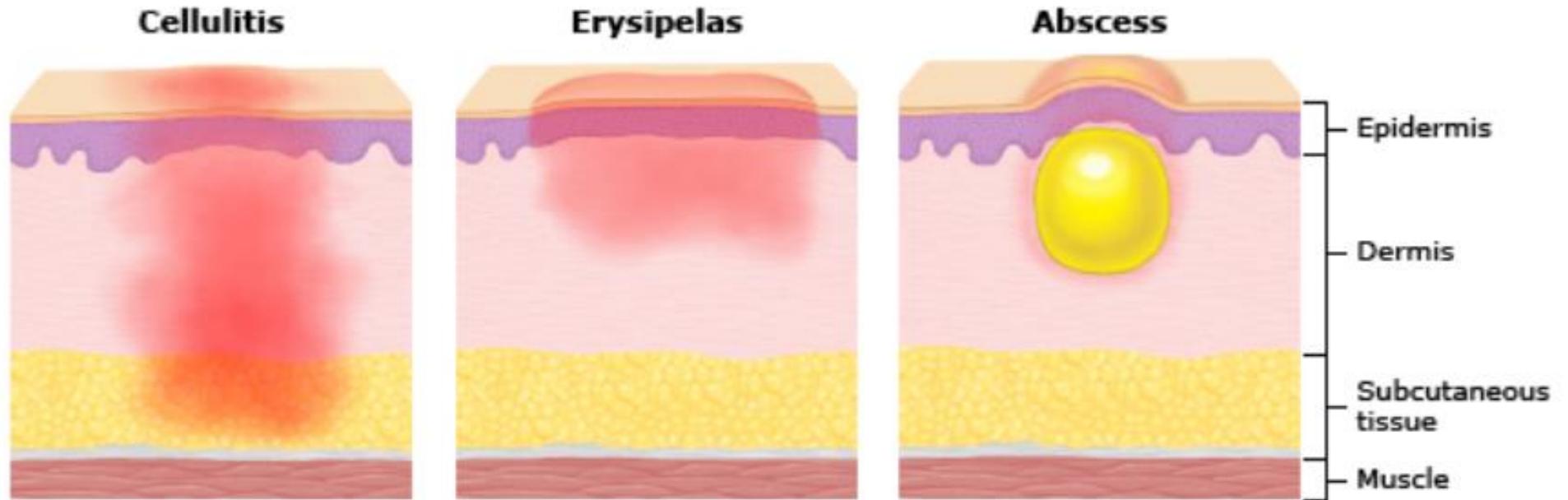
The most common cause of cellulitis is **beta-hemolytic streptococci (groups A, B, C, G, and F)**, most commonly group **A *Streptococcus* or *Streptococcus pyogenes***; *S. aureus* (including methicillin-resistant strains) is a notable but less common cause



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Skin anatomy: Cellulitis, erysipelas, and skin abscess





Skin abscess —

The most common cause of skin abscess is *S.*

aureus (either methicillin-susceptible or methicillin-resistant *S.*

aureus [MRSA]), which occurs in up to 75 percent of cases



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When to sample (e.g. swab skin)?

- Only when clinical concerns for infection.
- As per NICE
 - “Do not take a sample for microbiological testing from a **leg ulcer** at initial presentation, even if it might be infected.”

Which one is best? Deep tissue better than superficial tissue

- Before antibiotic therapy
- Wound swab
- Needle aspiration
- Irrigation
- Curettage of ulcer base
- Punch biopsy
- Deep tissue specimens
- Bone biopsy

• Least invasive



• Most Invasive

■ Least Specific



■ Most Specific



How to take a wound swab

- A superficial swab of the ulcer is not sufficient
- **Physically clean the ulcer** with sterile saline to remove debris from the wound bed
- The best specimens for culture are curettage or tissue biopsy from the base of the ulcer after cleaning and debridement
- Deliver to the microbiology laboratory in a timely fashion



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What to write on the request Forms?

CS203448

- Very important to write what signs of infection, relevant medical history (diabetes/immunosuppression), current/recent Antibiotics, allergies (ideally nature if penicillin)



"I tried to warn him -
garbage in, garbage out."



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- Only offer an antibiotic for adults with a leg ulcer when there are symptoms or signs of infection (for example, redness or swelling spreading beyond the ulcer, localised warmth, increased pain or fever)
- Very important to review the patient (ideally in person) and not offer antibiotics purely on Microbiology culture.



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Antibiotic choice

- Previous cultures
 - Previous treatment
 - Severity of wound/systemic symptoms
 - Likelihood of resistant organisms
-
- Be aware that it will take some time for a leg ulcer infection to resolve, with full resolution not expected until after the antibiotic course is completed.



Duration

Initial recommended duration is 7 days but should be based on clinical response. Treatment beyond 7 days may be required in some situations.

First line

Flucloxacillin (PO) 500mg-1g QDS

Penicillin allergy

Clarithromycin (PO) 500 mg BD

Or

Doxycycline (PO) 200mg stat then 100mg OD

Second Line Antibiotics

If the infection is worsening or not improving on first-line antibiotics, please review swab results. If swab results unavailable consider:-

Co-trimoxazole (PO) 960mg BD

If anaerobes suspected **ADD Metronidazole** (PO) 400mg TDS



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Pathogens implicated in special clinical circumstances

- *Pasteurella multocida* and *Capnocytophaga canimorsus*
- *Aeromonas hydrophila* and *Vibrio vulnificus*
- *Pseudomonas aeruginosa*
- Group B *Streptococcus*
- *Clostridium* species
- *Erysipelothrix rhusiopathiae*
- *Mycobacterium abscessus*



Case 1

A 45 year old shop assistant is admitted with an excruciatingly painful swollen left lower leg. There is some purplish discolouration over the calf with crepitus. She has a temperature of 39° C, her blood pressure is unrecordable and she is tachycardic.



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The clinical concern is

- A. Septic shock 2° cellulitis
- B. Necrotising fasciitis
- C. DVT with PE

Clinical signs (red flags) of necrotising infection

- Diffuse erythema
- Oedema
- Severe pain out of proportion to skin appearance
- Fever
- Crepitus
- Bullae, necrosis, ecchymosis (bruise-like appearance)
- +/- septic shock

The most likely causative organism is

- A. *Streptococcus agalactiae* (group B)
- B. *Streptococcus pyogenes* (group A)
- C. *Streptococcus dysgalactiae* (group C)
- D. *Staphylococcus aureus*
- E. *Staphylococcus epidermidis*



She is diagnosed with presumptive necrotising fasciitis. Blood cultures are taken and empirical antibiotics commenced. Appropriate empirical antibiotics could be*:

- A. Co-amoxiclav
- B. Benzyl-penicillin + gentamicin
- C. Vancomycin + gentamicin
- D. Meropenem + clindamycin**
- E. Benzyl-penicillin + clindamycin

***No 'wrong' answer given here – however D is most appropriate**

She is taken to theatre for emergency surgery. Necrotic tissue is thoroughly debrided and she is transferred to intensive care.

Surgical samples from theatre as well as admission blood cultures all culture **Group A streptococcus**, sensitive to penicillin.



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What type of antimicrobial is benzylpenicillin?

- A. Macrolide
- B. Lincosamide
- C. Quinolone
- D. Beta-lactam
- E. Glycopeptide



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Cell Wall Synthesis

B-Lactams

Penicillin
Cephalosporins
Monobactams
Carbapenems

Glycopeptides

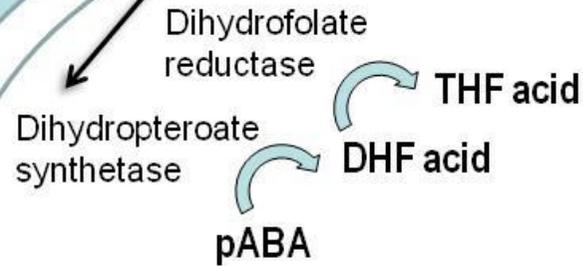
Vancomycin
Teicoplanin

Polymixins
Daptomycin

Cell membrane disruption

Folate synthesis

Sulphonamides
Trimethoprim



Nucleic Acid Synthesis

DNA gyrase

Quinolones

RNA polymerase

Rifampicin



50S subunit

Macrolides

Clindamycin

Linezolid

Chloramphenicol

EF-G

Fusidic acid

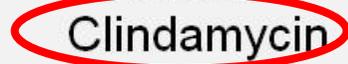
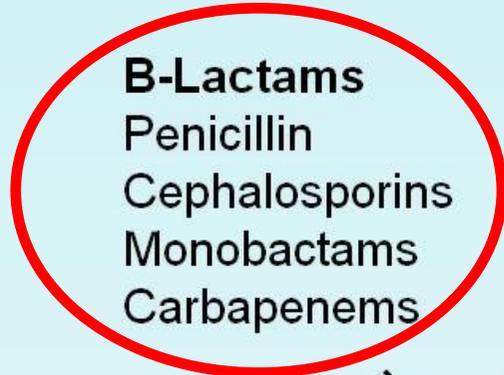
30S subunit

Aminoglycosides

Tetracyclines

50S

30S



Penicillin

- First beta-lactam discovered 1929
- Widespread resistance now due to penicillinases
- Group A streptococcus (and some other streptococci) + syphilis remain highly sensitive
- Short half life thus frequent dosing intervals
- Basis for other penicillins with broader spectrum



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Clindamycin is associated with high rates of antibiotic-associated diarrhoea and *C.difficile* and is only used in specific cases.

Why is it specifically used in this case?

- A. Good tissue penetration
- B. Anti-staphylococcal activity
- C. Anti-toxin activity
- D. Anaerobic cover
- E. In case of resistance to second antibiotic e.g. MRSA

She improves dramatically after the early extensive debridement.

Cultures are only positive for group A streptococcus.

The meropenem is switched to high dose iv benzylpenicillin on microbiology advice.

Learning points case 1

- Antibiotics alone are insufficient for successful treatment of necrotising fasciitis: **early and extensive surgical debridement is crucial**
- Clindamycin inhibits protein synthesis and is used here for its 'anti-toxin' effect
- Penicillin remains the drug of choice for (microbiologically proven) group A streptococcal infections



		MSSA	Streps *	Coliforms	Pseudo- monas	ESBLs #	Anaerobes
Penicillins	Penicillin V	Red	Green	Red	Red	Red	Yellow
	Amoxicillin	Red	Green	Yellow	Red	Red	Red
	Flucloxacillin	Green	Green	Red	Red	Red	Red
B-lactamase inhibitor combinations	Co-amoxiclav	Green	Green	Green	Red	Red	Green
	Pip-tazobactam	Green	Green	Green	Green	Red	Green
Cephalosporins	1 st generation Cephalexin	Green	Green	Yellow	Red	Red	Red
	2 nd generation Cefuroxime	Green	Green	Green	Red	Red	Red
	3 rd generation Ceftriaxone	Green	Green	Green	Red	Red	Red
	Ceftazidime	Yellow	Green	Green	Green	Red	Red
Carbapenems	Ertapenem	Green	Green	Green	Red	Green	Green
	Meropenem	Green	Green	Green	Green	Green	Green

*Does not include *Enterococcus sp.*

Extended Spectrum beta-lactamases

Simplified guide to beta-lactam spectra of cover, for reference only. Refer to guidelines for clinical use



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Case 2

- 84 year old with peripheral vascular disease and chronic superficial leg ulcer
- District nurse undertakes wound dressing
- Swab culture shows

Pseudomonas aeruginosa –meropenem and ciprofloxacin listed as options

- You are a GP trainee – the DN asks you what to do next...

Q&A

- I am the patient
- Find out more...
- Hx and O/E findings

What does the swab result mean?

- A. The patient is colonised with *P.aeruginosa*
- B. The patient is infected with *P.aeruginosa*
- C. The swab was contaminated with *P.aeruginosa*
- D. Any of the above – need more information



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What do you do about the result?

- A. Arrange to see the patient asap
- B. Ask the nurse to repeat the swab to confirm
- C. Call microbiology to discuss the result
- D. Prescribe oral ciprofloxacin for the Pseudomonas



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Take-home messages

- Skin is not sterile
- Wounds are not sterile

- Most leg ulcers are not clinically infected but are likely to be colonised with bacteria
- Microbiology specimens do not tell you if the wound is infected

- Growth of organisms \neq Infection
- Learn the red flags for **SEVERE SOFT TISSUE INFECTION** (e.g. necrotising fasciitis)

