

بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ
(وَفَوْقَ كُلِّ ذِي عِلْمٍ عَلِيمٌ)



جراحین

Pharmacology | FINAL 1

Skin Pharmacology

Pt.1



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Skin Pharmacology

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NOTE: In this lecture, we will cover the drugs that are used to treat skin pathological conditions Rather than the drugs that are administered through the skin only.

Adverse Effects of Dermatologic Preparations: (explained in the next slide)

Any drug applied on the skin.

- 1- Burning or stinging sensation caused by alcoholic preparation.
- 2- Drying and irritation
- 3- Pruritus. حكة
- 4- Erythema.
- 5- Sensitization.
- 6- Staining
- 7- Superficial erosion.

Further notes on the previous slide:

- 1) Drying and irritation are caused by the vehicle of the drug (the inactive substance or base used to carry/deliver the medication).
 - These side effects are not caused by the active drug itself.

- 2) Skin; Protection and Adverse Reactions:
 - **Primary Function:** The skin acts as a protective barrier from the outside environment.

 - **Allergic Reactions:** The skin can develop allergies, which may appear as:
 1. Pruritus: Itching
 2. Erythema: Redness
 3. Sensitization
 4. Staining: Discoloration of the skin
 5. Medication Side Effects: Example: Corticosteroids (Cortisone) can cause superficial erosion (the thinning of the skin layer).

Topical Antibacterial Agents

- **Gram-positive bacteria**
 - **Bacitracin**
 - **Gramicidin (similar to Bacitracin)**
 - **Fusidic acid**
- **Gram-negative bacteria**
 - **Polymyxin B Sulfate**
 - **Neomycin**
 - **Genatamicin**

BACITRACIN

Gram +

- Active against streptococci, pneumococci, and staphylococci (bacteria living on skin surface)
- Also , most anaerobic cocci, neisseriae, tetanus bacilli, and diphtheria bacilli are sensitive .
- **MOA???** Mechanism Of Action: cell wall synthesis inhibitor.
- **Side effects: Toxicity???** Bacitracin is primarily used as a topical medication rather than an oral one because it is not absorbed into the systemic bloodstream, which prevents adverse systemic toxicity.
- Allergic contact dermatitis occurs frequently, and immunologic allergic contact urticaria rarely (See next slide). Bacitracin is poorly absorbed through the skin, so systemic toxicity is rare.

Types of Allergic Skin Reactions:

1- Allergic Contact Dermatitis (Common):

- Occurs when a drug **directly touches** the skin.
- Results in **skin inflammation** (the suffix "-itis" indicates inflammation).

2- Allergic Contact Urticaria (Rare):

- Happens in people who have a **stronger immune response**.
- **Symptoms:** Redness over a large area, accompanied with small pimples and itchiness.



Combining medications helps cover and treat more than one type of bacteria at the same time.

For example, **Neosporin** is a combination of 3 antibacterial drugs:

- 1- Bacitracin for gram-positive bacteria.
- 2- Polymyxin for gram-negative bacteria.
- 3- Neomycin for gram-negative bacteria too.



- **1-** Bacitracin is frequently used in **combination** with other agents (polymyxin B and neomycin).
- 2- Form:** creams, ointments, and aerosol preparations (next slide)
- 3-** Usually **Anti-inflammatory** agents added such as Hydrocortisone or cortisone which is used to reduce the symptoms of inflammation and infection (such as redness, pain, and itchiness) rather than treating or curing the underlying cause. Cortisone lowers the body's immune response, so we must use it in a balanced way.

Drug Forms: ointments, creams, aerosols (sprays);

- **Formulation:** Different forms of a medication exist based on their **varying water and lipid (fat) content.**
- **(Aerosols/Sprays):** Aerosols have a **high water content.** They are highly effective for **hairy areas** like the scalp because they can reach the skin much more easily than thick ointments or creams.



Fusidic acid (Fucidin):

Gram +

- acts as a bacterial protein synthesis inhibitor
- Staphylococcus species, Streptococcus species, and Corynebacterium species.
- often used topically in creams and eyedrops (for eye infections).
- **Note:** Adding a corticosteroid to Fusidic acid (Fucidin) creates Fucicort, which serves to lower the inflammatory response.

POLYMYXIN B SULFATE

Gram -

- **Gram-negative :Pseudomonas aeruginosa, Escherichia coli, enterobacter, and klebsiella.**
 - **Proteus and serratia are resistant, as are all gram- positive organisms.**
 - **Side effects: total daily dose applied to denuded skin or open wounds **or skin burns** should not exceed 200 mg in order to reduce the likelihood of toxicity “neurotoxicity and nephrotoxicity” because conditions like burns result in a thinner skin layer, which allows for increased drug absorption through the skin (higher penetration).**
- Allergic contact dermatitis NOT common.

NEOMYCIN & GENTAMICIN:

Gram -

Neomycin:

- Aminoglycoside antibiotics (**protein synthesis inhibitors**) → (bactericidal, membrane damage).
- gram-negative :E coli, proteus, klebsiella, and enterobacter.
- SE: allergic contact dermatitis.

Gentamicin:

- Gentamicin generally shows greater activity against P aeruginosa than neomycin .
- Gentamicin more active against staphylococci and group A β -hemolytic streptococci.
- Be careful with systemic toxicity : esp in renal failure (**Next Slide**).

NEOMYCIN & GENTAMICIN:

Gram -

Renal (Kidney) Failure and Medication Management:

- **The Risk:** In patients with renal failure, drugs that are normally excreted by the kidneys (**Aminoglycoside AB**) cannot be cleared efficiently. This causes the drug to accumulate in the body, which can lead to **toxicity**.
- **Management Strategies:** To prevent toxicity in these patients, a doctor must do one of two things:
 - 1) **Adjust the dosage:** Lower or modify the dose of the kidney-excreted drug.
 - 2) **Change the medication:** Switch to a different drug that is not excreted by the kidneys.
- **Example: Aminoglycoside antibiotics** are a primary example of drugs that are excreted by the kidneys and carry a high risk of toxic accumulation if the patient has renal failure.

Trichogenic and Antitrichogenic Agents:

Note: Trichogenic agents increase hair growth ,while Antitrichogenic agents decrease hair growth.

- **Minoxidil (Rogaine) (Trichogenic Agent):**
 - Designed as an antihypertensive agent (treatment of high blood pressure).
 - **(1)** Minoxidil is a potassium channel opener causing hyperpolarization of cell membranes -> This prevents the Calcium channels opening, causing relaxation. **MOA: (1) (2)**
 - Causing widening blood vessels , it allows more oxygen, blood, and nutrients to the follicles. may act as a **(2)** nitric oxide agonist. This may cause follicles in the telogen phase to shed, which are then replaced by thicker hairs in a new anagen phase.
 - Effective in reversing the progressive miniaturization of terminal scalp hairs associated with androgenic alopecia (صلع). *تراجع خط الشعر*
 - Vertex balding is more responsive than frontal balding. **Side Effects: Hypotension**

Trichogenic and Antitrichogenic Agents

- **Finasteride (Propecia) (Trichogenic Agent):**
 - 5 α -reductase inhibitor which blocks the conversion of testosterone to dihydrotestosterone.
 - Oral tablets.
 - **Side Effects:** Can cause decreased libido, ^{مشاكل}ejaculation disorders, and ^{نقص الشهوة الجنسية}erectile dysfunction .
- **Androgenic Alopecia:** ^{بالانتصاب}In individuals with this condition, the expression of their traits is linked to the production of dihydrotestosterone.
- **Role of Dihydrotestosterone:** This hormone is responsible for secondary sex characteristics, such as facial hair growth and thickening of the voice.
- **Mechanism of Finasteride:** The medication works by lowering dihydrotestosterone levels.
- **Side Effects:** Because finasteride lowers this hormone, it will consequently cause side effects.

Trichogenic and Antitrichogenic Agents

- **Eflornithine (Antitrichogenic Agent):**
 - Is an irreversible inhibitor of ornithine decarboxylase, therefore, inhibits polyamine synthesis. Polyamines are important in cell division and hair growth.
 - Effective in reducing facial hair growth in 30% of women when used for 6 months.
- **Structural Similarity:** Eflornithine is structurally similar to ornithine.
- **Mechanism of Action:** Because of this similarity, Eflornithine binds *irreversibly* to the enzyme ornithine carboxylase.
- **Effect on Growth:** Normally, this enzyme acts upon ornithine to convert it into polyamines, which are necessary for growth. By binding to the enzyme, Eflornithine prevents this conversion.

Acne treatment

حب الشباب

✚ **One of the most common skin diseases presenting to family Physicians**

Considerable psychological impact on the quality of life.



Four main factors cause acne:

✚• **Hormonal Imbalance -> Excess oil (sebum) production.**

- **Hair follicles clogged by oil and dead skin cells.**

(بشكل يومي نظفت حال ما الجلد في طبقات تراكم)

- **Bacteria.**
- **Inflammation**

The anaerobic bacterium Cutibacterium acnes (Propionibacterium acnes)

✚ **is believed to play an important role in the pathophysiology of the common skin disease acne vulgaris.**

Comedonal Lesions

زوان او رؤوس سوداء
Black heads



Inflammatory Lesions



Nodulocystic Lesions

↳ Nodule filled with pus



Scarring

If Nodulocystic Lesions left untreated it can results in permanent scarring.



Therapy

1) Topical (Next slides)

2) Systemic

Topical Therapy (Indications)

- + **comedonal acne**
- + **mild to moderate inflammatory acne**

Topical Therapy

- + **cream** **sensitive or dry skin** **High water content**
- + **lotion** **-any skin type** **High water content**
- + **gel** **-oily skin**
- + **solution** **– oily skin**

Topical Therapy (Anti Comedonal Agents)

 **Topical Retinoids 0.025% - 0.5%**

 **Azelaic acid**

 **Salicylic acid**

Topical Retinoids (Adapalene, Differin)

Causes peeling of skin

✚ Topical Retinoids 0.025% - 0.5%

- apply at night
- always apply test dose; **for Allergy**
- start at low concentrations
- avoid in pregnancy Side

✚ Effects:

- pustular flare
- photosensitivity
- skin irritation and erythema
- dryness and peeling

حب بالبداية بظهر
هذه والسبب انه اكثر
تقشر طبقات الادوية
الجلد

Retinoids are
drivative of Retinoic
Acid, like Vitamin A

Avoid in Pregnancy



رسالة من الفريق العلمي:

عن أبي هريرة -رضي الله عنه-، عن النبي -صلى الله عليه وسلم- أنه قال:

"أَوَّلُ مَا يُقَالُ لِلْعَبْدِ يَوْمَ الْقِيَامَةِ: أَلَمْ أُصِحِّحْ جَسْمَكَ وَأُرْوِيكَ مِنَ الْمَاءِ الْبَارِدِ"

إنَّ أَوَّلَ مَا يُسْأَلُ عَنْهُ الْعَبْدُ يَوْمَ الْقِيَامَةِ مِنَ النِّعَمِ أَنْ يَقُولَ اللَّهُ تَعَالَى لَهُ: أَلَمْ نَصِحِّحْ لَكَ جَسْمَكَ؟ أَيُّ بَأْسٍ جَعَلْنَاكَ صَاحِبَ الْبَدَنِ وَصَاحِبَ السَّمْعِ وَالْبَصَرِ؛ فَإِنَّ صِحَّةَ الْبَدَنِ مِنْ أَعْظَمِ النِّعَمِ بَعْدَ الْإِيمَانِ، وَنُرْوِيكَ مِنَ الْمَاءِ الْبَارِدِ الَّذِي هُوَ مِنْ ضَرُورَةِ بَقَائِكَ وَلَوْلَاهُ لَفَنَيْتَ؛ وَلِهَذَا كَانَ جَدِيرًا بِالسُّؤَالِ عَنْهُ وَالْإِمْتِنَانِ بِهِ، فَمَاذَا عَمِلْتَ فِي هَذِهِ النِّعَمِ، وَهَلِ اسْتَعْمَلْتَهَا فِي طَاعَةِ اللَّهِ تَعَالَى أَمْ لَا؟ وَخَصَّ هَاتَيْنِ بِالْأَوَّلِيَّةِ لِأَنَّهُمَا أُمَّ النِّعَمِ.

For any feedback, scan the code or click on it.



Corrections from previous versions:

Versions	Slide # and Place of Error	Before Correction	After Correction
V0 → V1	Slide 18	زوال او رؤوس سوداء	زوان او رؤوس سوداء
V1 → V2			