7 Antimicrobials

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Introduction

Antimicrobial topics are important in dermatological practice. Indeed, cutaneous infections – and especially bacterial ones – account for a large part of dermatological patients. The physician must be aware of mechanisms of action of these drugs, as well as how their efficacy was tested.

Only a few classes of antibiotics are used as topical agents. Most topical antibiotics are safe and effective. Bacitracin is currently one of the most commonly employed topical antimicrobial agents. It has some other useful properties, and improves the rate of reepithelialization of a wound [11, 57]. Neomycin is widely thought of as a leading allergen, and its use in topical application is now not recommended. Gentamycin is an antibiotic prescribed by systemic administration; thus, its use in topical application tends today to be limited to severe cutaneous infections due to gram-negative microorganisms. Mupirocin is one of the newer antimicrobial ointments approved for topical treatment of primary skin infections such as impetigo or for secondary infections. It does not alter the rate of reepithelialization of a wound but retards wound contraction. Sodium fusidate or fusidic acid is a useful topical antibiotic with an activity spectrum against Staphylococcus aureus. Clindamycin has been shown to be effective in the treatment of patients with mild and moderate acne. This drug reduces the percentage of free fatty acids on surface sebum, and leads to a reduction of bacterial numbers on the skin. The greater efficacy of topical clindamycin in acne seems to be due to a higher lipid solubility and an accurate penetrative vehicle. Sulfadiazine has been used extensively in the treatment of burns [47] and skin-graft donor sites. It enhances healing time [31] and increases the rate of reepithelialization [19, 57]. It may be of help in wound healing since it retards wound contraction, perhaps a beneficial property in some cases.

Erythromycin is the prototype of the macrolide antibiotics. Its mechanism of action consists of penetrating the cell walls of susceptible bacteria and binding to the 50 S subunit of their ribosomes. Thus, erythromycin inhibits RNA-dependent protein synthesis. It is still an efficient antiacneic agent, even if it may induce resistance among Propionibacteria acnes. Tetracyclines belong to the most important topical antibiotics used in the treatment of acne [20]. When systemically administered, they have antimicrobial properties allowing reduction of the follicular microbial colonization. Nevertheless, rela-
tive lack of efficacy of topical tetracycline might be due to an inability to re-
duce the number of Propionibacteria [10], although it reduces the percentage
of free fatty acids in surface sebum. Moreover, tetracyclines demonstrated
poor skin penetration [50], and they are inactivated during skin penetration.
The rifamycins are bactericidal for intracellular and extracellular organisms.
They inhibit RNA synthesis and interact with DNA-dependent RNA poly-

Skin Absorption

The effectiveness of topical antibiotics, since they must act within the depth
of the skin, depends in part upon the extent to which they are absorbed. To
demonstrate skin penetration of a drug, a lot of quantitative methods and
pharmacological or biological techniques can be performed [49].

Models In Vitro

Cell Chambers

The process of absorption of a topical antibiotic agent may be likened to that
of in vitro models in which the absorption of a test solute through an iso-
lated preparation of the stratum corneum or total human or animal skin is
determined in a diffusion cell (a so-called penetration chamber). Some of
the determinants are the solute concentration, solvent volume, duration of
contact with the membrane, the binding tendency of the solute to the mem-
brane, the membrane composition and integrity, membrane wetness, and a
lot of different parameters such as distribution and diffusion coefficients and
solute formulation. Indeed, the role of the vehicle in the percutaneous ab-
sorption of drugs is now well established. Concerning different formulations
of clindamycin, percutaneous absorption varies greatly from 0.7% to 12.9%
of the applied dose in 24 h, depending on the vehicle [16]. The penetration
of fusidic acid into the horny layer and its permeation through the skin was
investigated in vitro in a penetration chamber using human skin [51]. This
model confirmed the barrier function of stratum corneum, and changes in
the horny layer increased the penetration test of the drug. The penetration
power of antiseptic creams, such as silver sulfadiazine (sulfadiazine is also
considered as an antibiotic) has been evaluated on an in vitro model with
pig skin [18].