Proper Choice of Base of Topical Medicaments

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Introduction

All topical drugs have to pass through the outermost layer of the skin before they can exert their pharmacologic effects. The stratum corneum of the epidermis is constructed like the “bricks and mortar” of a brick wall. The lipid substance originated from the keratinocytes constitutes the mortar of this biological wall. This natural barrier not only helps to prevent water from losing from the body but also exogenous substances from getting into the body. It is therefore easily envisaged that lipid soluble substances can pass through the stratum corneum better than the water soluble one. For the non-lipid soluble substance, alternative pathways such as transcellular transport, or diffusion through the sebaceous ducts, hair follicles or sweat ducts may be required for action. These substances can however be delivered by lipid carriers, the base, to the skin. The host factors may affect the bioavailability of the topical medicaments. Disrupted epidermis such as active eczematous state, better hydrated skin and skin under occlusion facilitates local absorption. Thinner skin as of the scrotum, face and neonates absorb local medicaments more efficiently as compared to the palms, soles, and normal adults respectively.

Many of the dictums in dermatologic therapeutics are established before the era of “evidence-based medicine”. This review article attempts to briefly outline the general principles of topical therapeutics from the perspective of a dermatologist in practice.

Choosing the preparation

The Polano triangle summarizes the composition of the vehicle (base) of various traditional topical formulations. Briefly, these are powder, grease, liquid, or combinations of any two (or three) of them. Examples are: ointment is pure grease, vanishing cream is “water in oil”, lotion or solution is purely liquid, shake lotion is “powder in liquid” and paste is “powder in grease” preparation. The pharmaceutical companies may sometimes use the terms more from the perspective of the consumers. Therefore doctors are strongly advised to read the product inserts for exactly what are the components and base of the topical drugs prescribed (see examples below).

Cream

Depending on the proportion of water to grease, cream can be water miscible and washed away easily or be thick and sticky. It is perhaps the commonest prescribed topical medicament. As it is less oily, messy and sticky, most patients find it more user-friendly as compared to ointment. Because of its water content, some patients may find it soothing as a result of water evaporated from the applied area, and therefore the classic teaching says that it is more suitable in acute weeping lesions. Nevertheless, also because of its water content, preservatives have to be added and as a result, it may lead to a higher risk of allergic contact dermatitis as compared to ointment. For the same token, some patients may find it irritating when it is applied to raw or “hyper-acute” lesions. It is understandable; the readers can imagine the feeling of running water to their newly injured wound. There are also patients especially ladies who have what they describe as “sensitive” skin, find themselves difficult to tolerate many cream preparations. Creams can be prepared by varying the proportion of water and grease. The standard aqueous cream is composed of about 70% water and 30% grease. Generally speaking, the higher the proportion of grease in the cream base, the more “oily” or “thick” the cream will be. This will affect the efficacy of the formulation if the cream is designed to be used as moisturizing cream. Although “thinner” preparation is more welcome by patients, they may be required to reapply the moisturizing cream more frequently in order to keep their skin hydrated and succulent. To illustrate, Oilatum Cream™ of Stiefel contains about 20% grease while Oilatum Plus™ of Stiefel contains more than 50% grease.

Storage of cream preparation may be more demanding as too warm and humid environment may facilitate the growth of environmental bacteria and fungi while too dry may desiccate the cream. Instruction for storage is not an uncommon oversight in the busy practice of doctors.

Ointment

These are formulations normally composed of greases, usually anhydrous, in semi-solid phase. The greases may be a combination of soft or liquid paraffin or lanolin or others. These preparations may be preservative free. They are more occlusive and hence preserve water in skin better as compared to cream. The classic teaching says that ointments are the better preparations for chronic and dry lesions. Most local patients do not however like ointment because of the greasiness
especially when it is required to be applied to the face, hairy areas, intertriginous areas, the palm and soles. Greasy preparations may however be used in the hairy areas to remove the greasy scales as in e.g. seborrhoeic dermatitis of the scalp of the newborn and psoriasis of scalp. Ointment is the only available preparation for some topical medicaments e.g. tacrolimus, mupirocin, Whitfield.

Gel

These are clear jelly like semisolid formulations composed of high molecular polymers (e.g. cetomacrogol) in an aqueous or alcoholic base. They are drying and hence cooling and not greasy. They are more suited for applying on greasy or hairy areas of the body such as the face and scalp. Because of their drying effect and perhaps also alcoholic component, they may cause irritation especially in those acute lesions. Fluocinolone acetonide has the gel formulation that is not uncommonly prescribed to treat scalp psoriasis. Clindamycin has the gel formulation to treat facial acne. Topical retinoid in cream base is better tolerated as compared to gel base formulation of the same concentration.

Lotion

Lotion is liquid formulation mostly composed of drugs dissipate or dispersed in an aqueous base. While some pharmaceutical companies reserve the term solution for liquid formulations that contain alcohols, the author suggests that doctors should refer to the package insert for detail description if the particular formulation contains alcohol or not. It is more user-friendly when the topical medicament is to be applied to a large area of the body or to hairy areas. Because the water/alcohol content within the lotion formulation is more easily evaporated, it will give a cooling sensation to the skin. An example is calamine lotion, a shake lotion (solid in water), that is commonly used for relieving the irritation of miliaria in children by making use of its cooling and hence soothing effect. As for the other aqueous preparations or those containing alcohol, it may cause irritation to raw areas or acute lesions and aggravate dryness of the skin. Occasionally, grease in water formulations may also be used as term lotion. These are usually skin care products in which the grease portion may only compose of less than 10-20% in the formulation e.g. 5% white soft paraffin in QV Skin Lotion™ of Ego.

Other preparations

There are also antifungals in powder formulations in the market. The advantage may be that it can absorb excessive sweating in areas such as the soles and does not have the slippery sensation when applied to the soles. Paste is solid in grease formulation. Tar paste is the classic example in this category. It has fallen out of fashion in recent years. Topical steroids and antifungals have also been prepared in spray formulations either locally or in other countries. Foam vehicles have also been developed to carry topical steroids in the US.

In-house mixing of your own formulation is generally not recommended. The ingredients and occasional bases may not be compatible with each other. There are also risks of contamination and non-homogenous mixing.

Other important ingredients within the base

Some formulations contain propylene glycol that enhances the bioavailability of the active ingredients e.g. Diprocel Cream™ Schering-Plough is more potent than Diprosone Cream™ Schering-Plough although both of them contain 0.05% betamethasone dipropionate. Because of the presence of propylene glycol in the former, it may sometimes lead to contact dermatitis either irritant or allergic. Lanolin that is in fact a group of heterogeneous fatty substances may be present in the cream/ointment base. Some patients may have allergic contact dermatitis to some of these substances.

Summary

Proper drug and formulation should be chosen according to the disease severity, sites involved and the personal profile of the host. Remember there are two components, the drug and the base in the topical formulations and we have to know what they are in order to maximize the therapeutic benefits.