

Quadrant II – Transcript and Related Materials

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Normal Microflora of Skin

Skin provides good examples of various microenvironments. Skin regions have been compared to geographic regions of Earth: the desert of the forearm, the cool woods of the scalp, and the tropical forest of the armpit. The composition of the dermal microflora varies from site to site according to the character of the microenvironment.

A different bacterial flora characterizes each of three regions of skin:

- (1) axilla, perineum, and toe webs;
- (2) hand, face and trunk; and
- (3) upper arms and legs. Skin sites with partial occlusion (axilla, perineum, and toe webs) harbor more microorganisms than do less occluded areas (legs, arms, and trunk).

These quantitative differences may relate to increased amount of moisture, higher body temperature, and greater concentrations of skin surface lipids. The axilla, perineum, and toe

webs are more frequently colonized by Gram-negative bacilli than are drier areas of the skin.

The number of bacteria on an individual's skin remains relatively constant; bacterial survival and the extent of colonization probably depend partly on the exposure of skin to a particular environment and partly on the innate and species-specific bactericidal activity in skin. Also, a high degree of specificity is involved in the adherence of bacteria to epithelial surfaces. Not all bacteria attach to skin; staphylococci, which are the major element of the nasal flora, possess a distinct advantage over viridans streptococci in colonizing the nasal mucosa. Conversely, viridans streptococci are not seen in large numbers on the skin or in the nose but dominate the oral flora.

The microbiology literature is inconsistent about the density of bacteria on the skin; one reason for this is the variety of methods used to collect skin bacteria. The scrub method yields the highest and most accurate counts for a given skin area. Most microorganisms live in the superficial layers of the stratum corneum and in the upper parts of the hair follicles. Some bacteria, however, reside in the deeper areas of the hair follicles and are beyond the reach of ordinary disinfection procedures. These bacteria are a reservoir for recolonization after the surface bacteria are removed.

The majority of skin microorganisms are found in the most superficial layers of the epidermis and the upper parts of the hair follicles.

Some examples of Microflora found on skin

- Coagulase negative *Staphylococci*
- Diphtheroids including *Propionibacterium acnes*
- *Staphylococcus aureus*

- *Streptococci* spp.
- *Bacillus* spp.
- *Malassezia* furfur
- *Candida* spp.
- *Mycobacterium* spp.

The anatomy and physiology of the skin vary from one part of the body to another.

- Unfavourable habitat for microorganisms are

---- periodic drying

---- acidic pH (4.0- 6.0)

---- high sodium chloride conc.

---- certain inhibitory substances

Eg: sweat glands---lysozyme

oil glands---oleic acid

- But in areas such as scalp, ears, axillary areas, genitourinary regions, anal regions, perineum, palms-high count of microflora is seen.
- Glands secretions contain water, amino acids, urea, electrolytes (salts), & specific fatty acids-----serve as nutrients.
- *Staphylococcus epidermidis* -----found in region of high moisture
- *Staphylococcus aureus*----- nose, perianal region
- Occurrence in nasal passage varies with the age being greatest in the newborns, less in adults.

Clostridium perfringens----- perineum, thighs

Propionibacterium acnes---the most prevalent bacterium in skin.

- **Predominant organisms of the Eye:**

Coagulase negative *Staphylococci*

Haemophilus spp.

S. aureus

Streptococcus spp.

Few anaerobic organisms are also present

Ear

- Microbiota of the external ear resemble that of the skin

- Most predominating:

Coagulase negative *Staphylococci* and *Corynebacterium*

- Less frequently found are:

Bacillus, *Micrococcus* & *Neisseria* spp.

- Occasionally seen are:

Proteus, *Escherichia* & *Pseudomonas*

Staphylococcus epidermidis

S. epidermidis is a major inhabitant of the skin, and in some areas it makes up more than 90 percent of the resident aerobic flora.

Staphylococcus aureus

The nose and perineum are the most common sites for *S. aureus* colonization, which is present in 10 percent to more than 40 percent of normal adults. *S. aureus* is prevalent (67 percent) on vulvar skin. Its occurrence in the nasal passages varies with age, being greater in the newborn, less in adults. *S. aureus* is extremely common (80 to 100 percent) on the skin of patients with certain dermatologic diseases such as atopic dermatitis, but the reason for this finding is unclear.

Micrococci

Micrococci are not as common as staphylococci and diphtheroids; however, they are frequently present on normal skin. *Micrococcus luteus*, the predominant species, usually accounts for 20 to 80 percent of the micrococci isolated from the skin.

Diphtheroids (Coryneforms)

The term diphtheroid denotes a wide range of bacteria belonging to the genus *Corynebacterium*. Classification of diphtheroids remains unsatisfactory; for convenience, cutaneous diphtheroids have been categorized into the following four groups: lipophilic or nonlipophilic diphtheroids; anaerobic diphtheroids; diphtheroids producing porphyrins (coral red fluorescence when viewed under ultraviolet light); and those that possess some keratinolytic enzymes and are associated with trichomycosis axillaris (infection of axillary hair). Lipophilic diphtheroids are extremely common in the axilla, whereas nonlipophilic strains are found more commonly on glabrous skin.

Anaerobic diphtheroids are most common in areas rich in sebaceous glands. Although the name *Corynebacterium acnes* was originally used to describe skin anaerobic diphtheroids, these are now classified as *Propionibacterium acnes* and as *P. granulosum*. *P. acnes* is seen eight times more frequently than *P. granulosum* in acne lesions and is probably involved in acne pathogenesis. Children younger than 10 years are rarely colonized with *P. acnes*. The

appearance of this organism on the skin is probably related to the onset of secretion of sebum (a semi-fluid substance composed of fatty acids and epithelial debris secreted from sebaceous glands) at puberty. *P. avidum*, the third species of cutaneous anaerobic diphtheroids, is rare in acne lesions and is more often isolated from the axilla.

Streptococci

Streptococci, especially β -hemolytic streptococci, are rarely seen on normal skin. The paucity of β -hemolytic streptococci on the skin is attributed at least in part to the presence of lipids on the skin, as these lipids are lethal to streptococci. Other groups of streptococci, such as α -hemolytic streptococci, exist primarily in the mouth, from where they may, in rare instances, spread to the skin.

Gram-Negative Bacilli

Gram-negative bacteria make up a small proportion of the skin flora. In view of their extraordinary numbers in the gut and in the natural environment, their scarcity on skin is striking. They are seen in moist intertriginous areas, such as the toe webs and axilla, and not on dry skin. Desiccation is the major factor preventing the multiplication of Gram-negative bacteria on intact skin. *Enterobacter*, *Klebsiella*, *Escherichia coli*, and *Proteus spp.* are the predominant Gram-negative organisms found on the skin. *Acinetobacter spp.* also occurs on the skin of normal individuals and, like other Gram-negative bacteria, is more common in the moist intertriginous areas.

Nail Flora

The microbiology of a normal nail is generally similar to that of the skin. Dust particles and other extraneous materials may get trapped under the nail, depending on what the nail contacts. In addition to resident skin flora, these dust particles may carry fungi and bacilli. *Aspergillus*, *Penicillium*, *Cladosporium*, and *Mucor* are the major types of fungi found under the nails.

