A Case Study of an Autologous Skin Microbiome Transplant

PROBLEM:
Atopic dermatitis (AD; “eczema”) is a chronic inflammatory skin disorder characterized by dry, itchy, rashes that usually occur on the face, inside the elbow, and behind the knees. It is very common in children, affecting 10-15% of all infants and children. The itching at times may be so severe that it interferes with sleep and normal activities, and scratching the skin worsens the disease by increasing inflammation and itch further. The pathogenesis of the disease is still unclear, but genetic, immune, and environmental factors have been implicated. Mutations in genes encoding proteins that form the skin barrier confer genetic risk to AD, which is also characterized by deficiencies in the skin barrier. Though not contagious, flares in AD are frequently heavily colonized with Staphylococcus aureus. It is hypothesized that S. aureus can trigger flares and/or modulate disease severity. AD often resolves over time, but children with AD are at risk later in life for developing other atopic diseases including asthma and hay fever. Current treatments include emollients (e.g. Aquafor), antibiotics, and topical corticosteroids.

S. aureus colonization of AD skin is associated with increased disease severity and places the patient at risk for S. aureus skin infections, including methicillin resistant S. aureus (MRSA). Therefore, controlling S. aureus burden through alternative (non-antibiotic) therapies could improve patient outcomes without promoting antimicrobial resistance. Recent work has concluded that some bacteria residing on healthy human skin have antimicrobial properties that inhibit S. aureus growth and may be beneficial for immune defense. Through high-throughput screening of healthy human skin isolates, specific strains of coagulase-negative Staphylococcus have been identified that inhibit S. aureus growth and enhance skin innate immune defense. Most AD patients are deficient in these beneficial strains, and increasing the abundance of such bacteria may benefit patients with AD.

PROPOSAL A:
The proposed is an autologous transplant involving an interventional clinical trial of the topical application of a defined combination of 4 beneficial bacteria isolated from the human skin microbiome. This trial will test if transplant of these isolates will benefit subjects with AD by decreasing S. aureus colonization and/or improve inflammation and skin barrier function.

TRANSPLANT PROCEDURE A:
The study team will selectively grow protective coagulase negative Staphylococcus isolates cultured from each subjects’ non-lesional skin and place them into a moisturizer. Each subject will receive moisturizer as well as moisturizer plus his/her own antimicrobial bacteria. The subject will apply the moisturizer to one arm and the moisturizer plus bacteria to the other arm daily for a total of 15 days. Subjects will return to the clinic every 5 days for skin swabs and clinical evaluations.

PROPOSAL B:
The proposed is a transplant involving an interventional clinical trial of the topical application of a less defined combination of skin microbiota isolated from the human skin microbiome of a healthy adult without eczema. This trial will test if transplant of healthy skin microbiota will benefit subjects with AD by decreasing S. aureus colonization and/or improve inflammation and skin barrier function.

TRANSPLANT PROCEDURE B:
The study team will harvest the skin microbiota from the antecubital fossa of a health adult without eczema and place the microbiota into a moisturizer. Each subject will receive moisturizer as well as moisturizer plus the transplanted microbiota. The subject will apply the moisturizer to one arm and the moisturizer plus
transplanted skin microbiota to the other arm daily for a total of 15 days. Subjects will return to the clinic every 5 days for skin swabs and clinical evaluations.

QUESTIONS:

1. Is this procedure a microbiota transplant?
2. Should it be regulated in the same way that FMT and other types of microbiota transplants (vaginal, nose, nares, skin) are regulated? If not, why not?
3. What distinguishes skin MT from a regulatory perspective?
4. Is the procedure a drug, a cosmetic, or a form of probiotic?

References

https://medlineplus.gov/eczema.html
https://clinicaltrials.gov/ct2/show/NCT02144142