Studies on colonization and infection with *Staphylococcus aureus* and other microbes in skin disease

Akademisk avhandling

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av

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Avhandlingen baseras på följande arbeten:

I. Alsterholm M, Flytström I, Leifsdottir R, Faergemann J, Bergbrant IM. Frequency of Bacteria, *Candida* and *Malassezia* Species in Balanoposthitis. Acta Derm Venereol 2008; 88: 331–336.

II. Alsterholm M, Flytström I, Bergbrant IM, Faergemann J. Fusidic Acid-resistant *Staphylococcus aureus* in Impetigo Contagiosa and Secondarily Infected Atopic Dermatitis. Acta Derm Venereol 2010; 90: 52–57.

III. Alsterholm M, Karami N, Faergemann J. Antimicrobial Activity of Topical Skin Pharmaceuticals – An *In vitro* Study. Acta Derm Venereol 2010; 90: 239–245.

IV. Alsterholm M, Strömbeck L, Ljung A, Karami N, Widjestam J, Gillstedt M, Åhren C, Faergemann J. Variations in *Staphylococcus aureus* Colonization and Disease Severity in Adults with Atopic Dermatitis during a 5-month Follow-up. In manuscript.

UNIVERSITY OF GOTHENBURG

Studies on colonization and infection with *Staphylococcus aureus* and other microbes in skin disease

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Abstract

The skin is colonized with a wide range of microbes. Some offer vital protection from colonization and infection with pathogenic strains while others have the capacity to cause or exacerbate disease. The aim of this thesis was to investigate the role and management of microbes found on skin affected by three disorders; balanoposthitis, impetigo and atopic dermatitis (AD).

Paper I investigates the frequency and distribution of bacteria, *Candida* and *Malassezia* species in balanoposthitis, a common inflammatory and/or infectious disorder of the prepuce and glans penis. Patients with balanoposthitis were colonized with microbes more often than a control group. Specifically, *S. aureus* was found in 19% of patients with balanoposthitis and not at all in the control group. There was no significant increase of *Candida* species in balanoposthitis. Different clinical manifestations did not predict the presence of specific microbes. There was no association with seborrhoeic dermatitis or psorisasis.

Paper II describes the bacterial spectrum and proportion of fusidic acid-resistant *S. aureus* (FRSA) in cultures from lesional skin in impetigo and secondarily infected AD. *S. aureus* was the most frequent finding (76-93%) and fusidic acid-resistance was found in 75%, 32% and 6.1% of *S. aureus* isolates form patients with bullous impetigo, non-bullous impetigo and secondarily infected AD, respectively.

In paper III the *in vitro* antimicrobial activity of topical skin pharmaceuticals was tested against *S. aureus*, *S. epidermidis*, *Streptococcus pyogenes*, *Escherichia coli* and *Candida albicans*. Formulations with clioquinol, halquinol and hydrogen peroxide had a broad antimicrobial effect. The azole class of antifungal formulations had an anti-staphylococcal effect.

Paper IV describes the variations in *S. aureus* colonization in relation to the severity of AD (assessed with SCORAD) in adult patients during a 5-month follow-up. High density of *S. aureus* on lesional skin, colonization of multiple body sites and persistent colonization with one strain was associated with more severe disease.

Conclusion: Balanoposthitis is associated with increased colonization with potentially pathogenic microbes. The primary therapeutic target in mild to moderate cases without overt signs of infection should be to decrease inflammation and microbial load with a topical corticosteroid-antimicrobial combination. FRSA are a common cause of impetigo but have remained relatively infrequent in secondarily infected AD. Use of topical fusidic promotes the spread of resistant strains and should be avoided. Topical non-resistance-promoting anti-septic formulations could be useful in the management of superficial skin infections and help reduce the use of systemic antibiotic treatment. Detailed investigation of different aspects of *S. aureus* colonization in relation to AD severity can increase understanding of the complex *S. aureus*-AD interaction and the possible value of anti-staphylococcal interventions in clinically non-infected AD.

Keywords: balanoposhtitis; microbes; *Staphylococcus aureus*; *Candida*; *Malassezia*; fusidic acid; fusidic acid-resistant *S. aureus*; impetigo; atopic dermatitis; azoles; clioquinol; halquinol; hydrogen peroxide; skin infection; SCORAD

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