

# Staphylococcus aureus decolonization for recurrent skin and soft tissue infections in children

Christine H. Smith MBBS Ran D. Goldman MD FRCPC

### Abstract

**Question** I see otherwise healthy children in my practice with recurrent staphylococcal skin infections. While I am comfortable with managing each acute infection, what can be done to eradicate *Staphylococcus aureus* and reduce the chance of recurrent infections?

**Answer** *Staphylococcus aureus* skin and soft tissue infections (SSTIs) are common in children and are increasing in frequency. Risk factors for the development of staphylococcal SSTIs are colonization with *S aureus* and recent diagnosis of SSTI in a household member. Current evidence suggests that a combined strategy using hygiene education, nasal mupirocin, and bath washes with chlorhexidine or diluted bleach has the most success in decolonization. However, decolonization appears to only provide temporary reduction in carriage rate. According to the limited research in the ambulatory population, decolonization of a patient does not confer a reduced risk of recurrent infections. Further research and large studies are required to understand the factors in *S aureus* pathogenesis and whether decolonization of a child and his or her household is of benefit in reducing subsequent *S aureus* infections.

### Décolonisation du staphylocoque doré pour les infections récurrentes de la peau et des tissus mous chez l'enfant

#### Résumé

**Question** Je vois dans ma pratique des enfants autrement en santé présenter des infections récurrentes de la peau causées par des staphylocoques. Je suis à l'aise de prendre en charge chaque épisode aigu d'infection, mais que peut-on faire pour éradiquer le staphylocoque doré et réduire le risque d'infections récurrentes?

**Réponse** Les infections de la peau et des tissus mous (IPTM) au *Staphylococcus aureus* sont fréquentes chez les enfants et leur incidence augmente. Les facteurs de risque de développer une IPTM au staphylocoque sont la colonisation par le *S aureus* et un récent diagnostic d'IPTM chez une personne qui habite avec l'enfant. Les données scientifiques actuelles font valoir qu'une stratégie combinant une éducation sur l'hygiène, de la mupirocine par voie nasale et des ablutions dans le bain à la chlorexidine ou avec de l'eau de Javel diluée a le plus de chance de réussir à décoloniser l'enfant. Par ailleurs, la décolonisation semble ne réduire que temporairement le taux d'hébergement. Selon des études de recherche limitées dans la population ambulatoire, la décolonisation d'un patient ne confère pas de réduction du risque d'infections récurrentes. Une recherche plus approfondie et des études de plus grande envergure sont nécessaires pour comprendre les facteurs dans la pathogenèse du *S aureus* et savoir si la décolonisation d'un enfant et de ses proches est bénéfique pour réduire les infections subséquentes au *S aureus*.

The dramatic increase in incidence of staphylococcal skin and soft tissue infections (SSTIs) over the past decade has involved a disproportionately large increase in these infections in the pediatric population.<sup>1,2</sup> One report found that from 1997 to 2005, there was a 173% increase in presentations of children with *Staphylococcus aureus* SSTIs to physician offices and emergency departments in the United States (increase from 10.1 to 27.6 visits per 1000 population;  $P < .001$ ).<sup>1</sup> In recent years,

community-acquired, methicillin-resistant *S aureus* (CA-MRSA) has become a noteworthy pathogen in SSTIs among ambulatory patients, with a recent study attributing 15% to 75% of SSTIs to CA-MRSA across 11 emergency departments in the United States.<sup>3</sup> In a Canadian study in the greater Toronto area, MRSA was isolated in 19% of patients with *S aureus* SSTIs.<sup>4</sup> Recurrence rates of *S aureus* SSTI exceed 20% within 3 months, resulting in this being a common reason for presentation to physicians.<sup>5,6</sup>

It is believed that personal colonization with *S aureus* and recent SSTI in a household member are risk factors for SSTIs in children.<sup>2,7</sup> The anterior nares, skin, gastrointestinal tract, and perineal area are the most common



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sites for *S aureus* carriage. Approximately 20% of the healthy population are considered to have persistent carriage of *S aureus*, while 30% have intermittent colonization and 50% are non-colonizers.<sup>6,8</sup> Nasal MRSA colonization is reported to be from 0.8% to 1.5% in the healthy ambulatory population<sup>9,10</sup>; however, the incidence is higher in hospitalized and other high-risk populations.<sup>6</sup> In children, a higher persistent carriage rate of *S aureus* has been reported, with rate reduction with age.<sup>8</sup> Similarly, children have a higher rate of MRSA colonization, at 2.5%.<sup>9</sup>

### Decolonization efficacy

In attempting to reduce the burden of recurrent infections, various decolonization strategies have been tested in trials. Most of the research has focused on *S aureus* decolonization strategies to control nosocomial outbreaks and minimize invasive staphylococcal infections in high-risk patients (eg, immunosuppressed patients, dialysis patients). Approaches used for ambulatory patients for *S aureus* decolonization include combinations of mupirocin nasal ointment, oral antibiotics (eg, rifampicin, doxycycline), chlorhexidine solution bath washes, and diluted bleach baths in conjunction with attention to general hygiene and wound care.<sup>2,11,12</sup> However, the Canadian Paediatric Society does not generally advise decolonization of children with CA-MRSA SSTIs, citing that there is generally poor success in achieving eradication.<sup>13</sup>

A recent randomized controlled trial compared the success in eradicating *S aureus* in ambulatory patients (N = 244) using different combinations of simple hygiene advice, mupirocin nasal ointment, chlorhexidine body wash, and diluted bleach baths. Eradication was assessed at 1 and 4 months. When compared with hygiene education alone (38% eradication), decolonization at 1 month following treatment was significantly more effective with mupirocin (56%,  $P = .03$ ) or mupirocin in combination with either diluted bleach baths (63%,  $P = .006$ ) or chlorhexidine body washes (55%,  $P = .05$ ). At 4 months, more participants receiving hygiene education alone were decolonized (48%), but the only significant improvement in eradication rates was when using combined hygiene education, mupirocin, and diluted bleach baths (71%,  $P = .02$ ). Recurrence rates of SSTIs in the study were 20% at 1 month, 36% at 4 months, and 49% at 6 months. The only treatment that conferred a significant reduction in recurrent SSTI rates was in participants who received education, mupirocin, and chlorhexidine body washes (11%, compared with education alone at 26%;  $P = .03$ ), which was observed only at 1 month following treatment.<sup>14</sup>

### Individual or household decolonization?

As household members who are asymptomatic carriers of *S aureus* might serve as a reservoir for transmission and

infection in children, decolonization of entire households has been undertaken in attempts to reduce recurrent SSTIs. However, the relationship between colonization in household members and subsequent infections in other household members is still unclear.<sup>2</sup> Among 183 children with SSTIs requiring incision and drainage, *S aureus* was documented in half (53%) of household members (N = 661) with a substantially higher CA-MRSA carriage rate (21%) than previously documented in the healthy general population (1.5%).<sup>2</sup> Evidence is lacking as to whether decolonization of household members in addition to the person experiencing recurrent SSTIs will confer reduction in SSTIs.

### Mupirocin resistance

With the increase of community-acquired, methicillin-sensitive and methicillin-resistant *S aureus*, as well as concerns for the progressive development of drug resistance, topical antibacterial therapies have been a preferred method for *S aureus* decolonization. Mupirocin is most commonly used in topical form intranasally to assist in *S aureus* decolonization. Mupirocin theoretically has a low chance of cross-resistance owing to being structurally different from many other antibiotics.<sup>11</sup> However, there have been documented epidemics of mupirocin-resistant *S aureus* within the hospital settings,<sup>15,16</sup> as well as reduced mupirocin susceptibility in the community.<sup>17</sup> Methicillin-resistant strains were also twice as likely to demonstrate mupirocin resistance.<sup>16</sup> This plasmid-mediated resistance is associated with frequent, inappropriate, and prolonged exposure to mupirocin.<sup>17,18</sup>

### Conclusion

There are factors implicit in *S aureus* and particularly community-acquired *S aureus* pathogenesis that, as yet, are not understood. As treatment failure from decolonization procedures is common, the Canadian Paediatric Society does not usually advise decolonization of otherwise healthy children with CA-MRSA SSTIs.<sup>13</sup> Further research, including large, longitudinal studies, is required to assess the efficacy of decolonization strategies in individual and household members in the reduction of recurrent SSTIs. Current evidence suggests that decolonization is transient and does not affect infection recurrence.

#### Competing interests

None declared

#### Correspondence

Dr Ran D. Goldman, BC Children's Hospital, Department of Pediatrics, Room K4-226, Ambulatory Care Bldg, 4480 Oak St, Vancouver, BC V6H 3V4; telephone 604 875-2345, extension 7333; fax 604 875-2414; e-mail [rgoldman@cw.bc.ca](mailto:rgoldman@cw.bc.ca)

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