Clonal Enrichment of Integrated Resistance Plasmid-containing Staphylococcus aureus in a Burn Centre Associated with Persistent Carriage Among Health Care Workers.

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Abstract

Objectives

Burn wound surfaces are generally infected by S.aureus, but the reservoirs and transmission routes remain to be elucidated.

The genetic population structure of serial S.aureus isolates obtained from patients and healthcare workers (HCWs) in a burn centre was investigated. We assessed the frequency of auto- versus exo-infection and established a model describing import and local persistence of S.aureus clones.

Methods

Three populations of S.aureus isolates were collected (2001-2005) and typed by PFGE. Population I comprised 375 strains from HCWs. Population II harboured 586 nosocomially acquired strains from burn wounds. Population III involved 202 strains from patients at admission. Comparative genome hybridisation (CGH) was performed for endemic versus incidental S.aureus strains.

Results

The diversity index for Population III was significantly higher than those for Populations I and II. These PFGE-types were clearly endemic among HCWs and nosocomially acquired S.aureus strains. CGH revealed that endemic strains possessed an integrated plasmid encoding resistance to heavy metals.

Conclusion

Genetic diversity for S.aureus strains circulating in the burn centre was lower than that of strains in the open community. Apparently, endemic S.aureus clones have a superior potential to colonize burns which may be associated with their heavy metal resistance in an environment where silver and cerium containing topical agents are the most used.

Introduction

In burn centres, patients as well as health care workers (HCWs) may continuously introduce new staphylococcal strains to the centre, but it is not known whether each of these strains has similar capabilities to colonize burn wounds, spread and become endemic. The aim of this study, therefore, was to investigate the population structure of S. aureus isolates systematically obtained from patients and HCWs of a burn centre over a period of 5 years.

Materials and Methods (continued)

Setting: Burn Centre of the Martini Hospital, Groningen, The Netherlands

Decontamination regimens:
- silver sulphadiazine in combination with cerium nitrate
- selective decontamination of the digestive tract (SDD)

S. aureus strain collections:
- Population set I (n=375): isolates from swabs of the vestibulum nasi of HCWs
- Population II (n=586): nosocomially acquired strains from burn wounds
- Population III (n=202): strains from patients at admission

Table 1 shows the characteristics for each of the three Population sets of S. aureus.

PFGE-types, n (%)

- Cultures positive for S.aureus, n (%) 375 (23.0) 586 (23.3) 202 (12.6)
- S. aureus isolates genotyped, n (%) 336 (89.6) 481 (82.1) 168 (83.2)
- PFGE-types, n 29 41 33

Simple diversity index (95% CI)
- Individuals, n 1.068 (5.9-12.2) 1.068 (6.2-11.4) 1.068 (13.9-26.5)

Conclusions

Genetic diversity for S. aureus strains circulating in the burn centre was lower than that of strains in the open community. Microanalysis showed that genes discriminating endemic strains from non-endemic strains were located on an integrated plasmid.

Table 2. S. aureus genes which are significantly associated with endemic strains

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<thead>
<tr>
<th>Gene annotation</th>
<th>endemic strains</th>
<th>non-endemic strains</th>
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<tr>
<td></td>
<td>leu256</td>
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