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Incidence of oral indigenous bacteria in causative strains isolated from blood cultures in 759 laboratory-confirmed cases of bacteremia

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Abstract

Background: The incidence of oral indigenous bacteria in cases of bacteremia has been reported in only a few studies. We investigated the annual incidence of oral indigenous bacteria isolated in blood cultures from patients with bacteremia and call into consideration the impact of oral health measures implemented at our facility.

Methods: In the period from 2001 to 2006, 759 laboratory-confirmed cases of bacteremia were reported and subsequently analyzed in this study. The incidences of the causative strain and oral indigenous bacteria in blood cultures were studied by year.

Results: In 759 cases of bacteremia, oral streptococci were noted in 14 (1.8%), and anaerobic bacteria were noted in 9 (1.2%). The population of microorganisms did not change significantly during the study period.

Conclusions: In a previous report, oral streptococci accounted for 3.8% of those under investigation. In this study, the incidence of oral streptococci was significantly low, 1.8% specifically. A focus on oral health care at our hospital may account for a reduced incidence of oral streptococci bacteremia.

Keywords: oral indigenous bacteria, oral streptococci, anaerobic bacteria, blood culture, bacteremia

Background

Septicemia from the oral region may occur as the result of bacteria-containing blood inflow from an infected odontogenic lesion in the alveolar bone, gingival bleeding, or stomatitis. Personal oral cleaning with regular examination and treatment by oral health care professionals decreases oral streptococci on teeth and oral mucosal surfaces and improves gingival bleeding and stomatitis. Oral health care in patients with compromised immunity may be effective in the prevention of not only aspiration pneumonitis but also septicemia from the oral region.

The strains of microorganisms isolated from blood cultures in cases of septicemia have been investigated sufficiently, but the incidence of oral indigenous bacteria in cases of bacteremia has been reported in only a few studies [1, 2]. We therefore investigated the annual incidence of oral indigenous bacteria isolated in blood cultures from patients with bacteremia.

Methods

At Tonami General Hospital, Tonami, Japan, in the period from 2001 to 2006, 759 laboratory-confirmed cases of bacteremia were reported and subsequently analyzed in this study. The incidences of the causative strain and oral indigenous bacteria in blood cultures were studied by year. Oral streptococci and anaerobic bacteria, such as *Peptostreptococcus*, *Bacteroides fragilis*, and *Porphyromonas gingivaris*, were classified as oral indigenous bacteria. Furthermore, we analyzed the differences according to the annual incidence of the oral indigenous bacteria using the chi-square distribution test.

Samples were inoculated into SA aerobic and SN anaerobic blood culture bottles and were processed in the BacT/ALERT 120 automated system (BIOMERIEUX, Tokyo, Japan). Subculture and further identification of the isolated bacteria were performed by conventional microbiological techniques using the WalkAway-96 automated system (Dads Behring, Tokyo, Japan). Results were analyzed using a data management system (Noteware, Tokyo, Japan).

Results

1. Incidence of causative strains in blood cultures

Bacteria isolated from blood cultures and their changes in incidence by year are shown in Table 1. The incidence of *Staphylococcus* was high, 30%; the incidence of

Staphylococcus epidermidis was 13.2% and that of *Staphylococcus aureus* was 10.3%. The incidence of enterobacteria was high, 25%; the incidence of *Escherichia coli* spp. was 16.2% and that of *Klebsiella* spp. was 13.2%. The population of microorganisms did not change significantly during the study period.

2. Incidence of oral indigenous bacteria

The incidences of oral indigenous bacteria isolated from blood cultures are shown in Table 1 and Table 2. In 759 cases of bacteremia, oral streptococci were noted in 14 (1.8%). *Streptococcus oralis*, *S. sangius*, *S. mitis*, *S. salivarius*, *S. intermedius*, and *S. anginosus* were isolated as oral streptococci. Anaerobic bacteria were noted in 9 (1.2%). *Peptostreptococcus*, *Bacteroides fragilis* and *Porphyromonas gingivaris* were isolated as anaerobic bacteria. Changes in the incidence of oral indigenous bacteria by year are shown in Table 1. The population of microorganisms did not change significantly during the study period.

Discussion

1. Incidence of causative strains in blood cultures

In this study, high frequencies of staphylococcus and enterobacteria were isolated. These findings agree with the results of recent studies [3, 4]. Because the incidence of *Staphylococcus epidermidis* is typically high, this microorganism may be isolated as a contaminant resulting from blood drawing. Among our results and those of other studies [3, 4], no significant difference (chi-square test) was found in the incidence of this microorganism. This suggests that the incidence of contamination from blood drawing in our hospital is not higher than in other institutions.

2. Incidence of oral indigenous bacteria

Few studies on oral indigenous bacteria in bacteremia have been published [1, 2], probably because of its low incidence. In previous reports, oral streptococci and *Streptococcus milleri* accounted for 3.8% [2] and 1.6% [1], respectively, of bacteremia cases. In this study, the incidences of oral streptococci and *Streptococcus milleri* were significantly low (chi-square test), 1.8% ($p=0.040$) and 0.3% ($p=0.008$), respectively. Personal oral cleaning with regular examination and treatment by oral health care professionals decreases oral streptococci on teeth and oral mucosal surfaces, and improves gingival bleeding and stomatitis. An oral health care team was established at our hospital [5], and has reported previous findings [6]. In general

hospitals with many inpatients, it is difficult to perform oral screening and cleaning for all inpatients. We implemented mandatory use of an easy assessment sheet and education of the staff members, leading to an increase in the incidences of screening and oral cleaning. After the oral care, the oral conditions improved significantly. Oral health care at our hospital may account for a reduced incidence of oral streptococci bacteremia.

No study of the incidence of oral indigenous anaerobic bacteria in blood cultures from patients with bacteremia has been reported prior to this one. The prevention of anaerobic bacteria bacteremia by oral cleaning alone is difficult, because the anaerobic bacteria are present in anaerobic conditions with limited access such as abscesses in deep gingival pockets and alveolar bone. The clinical practice of dentistry is necessary to remove these lesions and the anaerobic bacteria that can cause bacteremia.

The incidence of oral indigenous bacteria was low at 3%, and did not change significantly during the study period. These results indicate that these microorganisms do not increase rapidly like prophlogistic bacteria in nosocomial infections.

Conclusions

In 759 cases of bacteremia, we investigated the annual incidences of the causative strain and oral bacteria in blood cultures. Oral streptococci were found in 14 cases (1.8%) and anaerobic bacteria were found in 9 cases (1.2%). The population of microorganisms did not change significantly during the study period. In a previous report, oral streptococci accounted for 3.8%. In this study, the incidence of oral streptococci was significantly low, 1.8%. A focus on oral health care at our hospital may account for a reduced incidence of oral streptococci bacteremia.

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Table 1 Positive strain in blood cultures

MIcroorganism	2001	2002	2003	2004	2005	2006	Total (%)
Streptococcus	**9**	**4**	**5**	**5**	**10**	**10**	**43 (5.7)**
Oral Streptococci	2	1	1	2	5	3	14 (1.8)
Others	7	3	4	3	5	7	29 (3.8)
Peptostreptococcus	**0**	**0**	**0**	**1**	**1**	**1**	**3 (0.4)**
Bacteroides fragilis	**0**	**0**	**1**	**0**	**1**	**3**	**5 (0.7)**
Porphyromonas gingivalis	**0**	**0**	**0**	**0**	**0**	**1**	**1 (0.1)**
Staphylococcus	**26**	**14**	**40**	**31**	**53**	**65**	**229 (30.2)**
S. epidermidis	7	5	18	12	26	32	100 (13.2)
S. aureus	14	7	13	15	14	15	78 (10.3)
Others	5	2	9	4	13	18	51 (6.7)
Enterobacteria	**36**	**31**	**29**	**43**	**57**	**43**	**239 (24.5)**
Klebsiella spp.	11	8	5	10	9	14	57 (13.2)
Escherichia coli spp.	13	17	17	19	36	21	123 (16.2)
Enterobactor spp.	6	0	3	6	3	3	21 (2.8)
Citrobactor spp.	0	0	0	0	1	2	3 (0.4)
Aeromonas spp.	0	0	0	1	2	0	3 (0.4)
Serratia spp.	2	4	2	5	4	2	19 (2.5)
Proteus spp.	4	2	2	2	2	1	13 (1.7)
Pseudomonas spp.	**7**	**3**	**4**	**5**	**4**	**7**	**30 (4.0)**
Acinetobactor spp.	**9**	**0**	**0**	**2**	**1**	**4**	**16 (2.1)**
Enterococcus spp.	**3**	**7**	**3**	**6**	**6**	**6**	**31 (4.1)**
Candida spp.	**7**	**5**	**8**	**15**	**11**	**8**	**54 (7.1)**
Bacillus spp.	**6**	**2**	**7**	**13**	**10**	**29**	**67 (8.8)**
Others	**11**	**6**	**5**	**8**	**6**	**5**	**41 (5.4)**
Total	**114**	**72**	**102**	**129**	**160**	**182**	**759**

Table 2 Oral indigenous bacterium

Oral streptococci	14	Anaerobic bacterium	9
S. oralis	4	Peptostreptococcus	3
S. sangius	2	Bacteroides fragilis	5
S. mitis	3	Porphyromonas gingivalis	1
S. salivarius	3		
S. intermedius/milleri	1		
S. anginosus/milleri	1		