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The Effect of Perioperative Oral Function Management of Patients Undergoing Chemotherapy, Based on Blood Culture Tests

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Abstract

When undergoing chemotherapy, it is easy for patients to develop an intraoral disorder as an adverse event. If intraoral disorder worsens, we cannot but stop chemotherapy. In this situation, oral bacteria are often detected in the blood. The goal of perioperative oral function management (POMF) during chemotherapy is to allow chemotherapy to proceed smoothly while maintaining the intraoral environment at a high standard. We chose cases of oral bacteria that were detected in the blood cultures of chemotherapy patients and investigated the effect of the intervention of perioperative oral function management. From January 2010 to December 2015, oral bacteria were detected in the blood cultures of 33 patients during chemotherapy. Among these patients, 24 cases were not involved in POMF in 24 cases. Nine patients were POMF intervention patients but were not yet achieved. Also, oral bacteria were not detected from blood culture tests from patients who were able to achieve treatment plan by POMF intervention. Based on these findings, intervention before initiating chemotherapy decreased the detection of oral bacteria in predominance in blood culture tests. Perioperative oral function management before initiating chemotherapy is important to allow chemotherapy to proceed smoothly.

Introduction

When chemotherapy is administered, intraoral problems can become a factor for stopping chemotherapy [1]. It is important that perioperative oral function management (POFM) supports the completion of chemotherapy without oral and systemic problems. If a situation exists so that oral function management cannot be performed such as the use of incompatible dentures, uncontrolled tooth caries, periodontal disease, or several intraoral bacterial count results during chemotherapy, then an oral bacterial infection associated with mucositis may produce bacteremia and sepsis during the period of myelosuppression [2]. These situations can be prevented if appropriate POFM is performed. Blood cultures are examined when bacteremia and sepsis are suspected, and oral bacteria are commonly detected [3]. We chose patients in whom oral bacteria were detected by blood culture tests during chemotherapy, and we investigated the presence of the POFM and report it because we examined the effect backward.

Materials and Methods

Study Patients

From January 2010 to December 2015, the blood cultures of 5052 patients were examined at Miyazaki University Hospital (Miyazaki, Japan). Oral bacteria were detected in 71 patients. Eight hundred sixty-three patients underwent blood culture tests during chemotherapy. Among them, 33 cases of oral bacteria were detected, and were the subject of this study. During the study period, 2964 patients underwent chemotherapy at our hospital.

Perioperative Oral Function Management

Since April 2012, the intervention of POFM has been performed at the Oral Maxillofacial Surgery Department of Miyazaki University Hospital (Miyazaki, Japan) and was administered only to patients whose chief physician had requested the intervention. For POFM, we performed an intraoral close inspection, periodontal basic testing, intraoral cleaning, scaling, and cleaning instruction at the initial diagnosis. The cleaning instruction took effect with the goal of plaque control record of less than 20%. After this instruction, patients underwent treatment for dental caries and

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tooth extraction to remove as much infection as possible. In addition, dental hygienists provided specialized plaque control and oral mucosal care 2-3 times weekly for patients undergoing radiation therapy and chemotherapy. Patients who finished these treatments before the start of chemotherapy were regarded as the POMF intervention/achievement group. Patients who did not complete scheduled treatment or patients who intervened with POMF after initiation of chemotherapy were regarded as the POMF intervention/incomplete group. Patients who had no intervention were regarded as the POMF nonintervention group.

Blood Culture Test

Blood culture tests were performed using BD BACTEC™ Instrumented Blood Culture Systems. Two or more pairs of blood samples were taken from different sites with one set of blood collected for aerobic culture and anaerobic culture vials. Blood culture tests were used to test for infectious disease, to assess patients suspected of having sepsis, and to assess patients with unknown fever during chemotherapy. In this study, the oral bacteria that we identified were Actinobacillus actinomycetemcomitans, Actinomyces israelii, Actinomyces meyeri, Actinomyces naeslundii, Actinomyces odontolyticus, Actinomyces viscosus, Bacteroides capiliosus, Bacteroides gracilis, Bifidobacterium spp, Branhamella catarrhalis, Capnocytophaga, Clostridium histolyticum, Clostridium tertium, Clostridium tetani, Corynebacterium pseudodiphtheriae, Corynebacterium spp, Corynebacterium xerosis, Eikenella corrodens, Eubacterium lentum, Eubacterium limosum, Fusobacterium nucleatum, Fusobacterium spp, Gemella morbillorum, Haemophilus influenza, Haemophilus parainfluenzae, Lactobacillus casel, Lactobacillus fermentum, Lactobacillus jensenii, Lactococcus lactis ssp cremoris, Lactococcus lactis ssp lactis, Mycoplasma orale, Peptostreptococcus micros, Peptostreptococcus prevotii, Porphyromonas asaccharolytica, Porphyromonas endodontalis, Porphyromonas gingivalis, Prevotella buccae, Prevotella corporis, Prevotella denticola, Prevotella intermedia, Prevotella loescheii, Prevotella melaninpgenica, Pervotella oris, Propionibacterium propionicus, Streptococcus anginosus, Streptococcus constellatus, Streptococcus intermedius, Streptococcus mitis, Streptococcus mutans, Streptococcus oralis, Streptococcus salivarius ssp. salivarius, Streptococcus sanguis, Veillonella alcalescens, Veillonella parvula, and Veillonella spp. These bacteria intended for the detected patients from arterial blood or venous blood gathered by a culture bottle submitted to clinical laboratory department in our hospital.

Treatment	Cases, no. (%)
Radiation	0 (0%)
Chemotherapy	33(87)
Radiochemotherapy	2 (5)
Operation	3 (8)
Total	38(100)

Table 1: Breakdown of the treatments and patients with oral bacteria detected in blood culture tests during cancer treatment

Disease	No. of patients
Acute myeloid leukemia	17 (52)
Acute lymphocytic leukemia	6(18)
Malignant lymphoma	5(15)
Rectal cancer	1(3)
Granulocyte sarcoma	1(3)
Medulloblastoma	1(3)
Hepatocellular carcinoma	1(3)
Ovarian cancer	1(3)
Total	33(100)

Table 2: Breakdown of the diseases of patients with oral bacteria detected in blood culture tests during chemotherapy

Results

Among 5052 patients, 71 (1.4%) cases of oral bacteria were detected in the arterial blood culture and venous blood culture test conducted at the clinical laboratory department in our hospital from January 2010 to December 2015, and 38 cases of oral bacteria were detected during cancer treatment. Among 38 patients, 33 (87%) patients were treated by chemotherapy; two (5%) patients, by radiochemotherapy; and three (8%) patients, by surgery (Table 1). There were 863(17%) of 5052 patients who underwent blood culture tests during chemotherapy. The main diseases and percentages among 33 chemotherapy patients were acute myeloid leukemia, 52% (17 patients); acute lymphocytic leukemia, 18% (six patients); malignant lymphoma, 15% (five patients); rectal cancer, 3% (one patient); granulocyte sarcoma, 3% (one patient); medulloblastoma, 3% (one patient); hepatocellular carcinoma, 3% (one patient); and ovarian cancer, 3% (one patient) (Table 2). Table 3 shows information concerning the oral bacteria detected in the blood cultures of 33 patients. The oral bacteria rate of detection in blood cultures of patients who received chemotherapy was 1.1% (33/2964 patients). Perioperative oral function management in 336/2964

	Leukemia	Malignant lymphoma	Rectal cancer	Granulocytic sarcoma	Medulloblastoma	Hepatocellular carcinoma	Ovarian cancer	Total
Streptococcus mitis	9	1	-	-	-	1	-	11
Streptococcus oralis	12	-	-	1	1	-	-	14
Neisseria elongata	-	-	-	-	-	-	1	1
Neisseria lactamica	-	1	-	-	-	-	-	1
Eubacterium sp.	-	-	1	-	-	-	-	1
Streptococcus sp	-	1	-	-	-	-	-	1
Fusobacterium nucleatum	-	1	-	-	-	-	-	1
Capnocytophaga sp.	-	1	-	-	-	-	-	1
Fusobacterium sp.	1	-	-	-	-	-	-	1
Corynebacterium spp	1	-	-	-	-	-	-	1
Total (no. of patients)	23	5	1	1	1	1	1	33

Table 3: Information on oral bacteria in the blood cultures of 33 patients

	Perioperative oral function management			
Oral bacteria	nonintervention	intervention/ incomplete	intervention/ achievement	Total
Detected	24	9	0	33
Not detected	2604	154	173	2931
Total (no. of patients)	2628	163	173	2964

Table 4: Presence or absence of the intervention of the perioperative oral function management for patients with oral bacteria detected in blood culture tests

chemotherapy patients was the intervention administered from April 2012 to March 2015. There were 173 (8%) patients in the POMF intervention/achievement group, 163 (6.4%) patients in the intervention/incomplete group, and 2628 (86%) patients in the nonintervention group. Of the 34 cases of oral cavity bacteria detected in blood culture tests, 0 cases were in the intervention/achievement group, 9 (27%) cases in the intervention/incomplete group, and 24 (73%) cases in the nonintervention group. In the intervention/achievement group, oral bacteria were not detected in the blood culture tests during chemotherapy (Table 4).

Discussion

Chemotherapy is important in the treatment of cancer [4,5]. Depending on the chemotherapy regimen, a severe systemic state resulting from oral mucositis can occur, and has been frequently been reported [6-8]. The goal of perioperative oral cavity function management is to prevent the exacerbation of the overall status due to oral mucositis and to facilitate the successful execution of the chemotherapy. It is performed for the purpose of providing high-quality medical care. It has been reported when an exacerbation of oral mucositis with the chemotherapy and the myelosuppression of the adverse event appear for the same period, it produces bacteremia and sepsis; as a result, oral bacteria is detected by blood culture test [9]. In particular, cases of hematapostema disease during chemotherapy is reportedly more likely to be detected as oral bacteria in a blood culture test [10]; our study showed a similar result. Further reduction in the number of oral bacteria according to the practice of chemotherapy before the POFM and the removal of an intraoral infection nest has been reported to inhibit the emergence of bacteremia and sepsis [11].

We examined the effects and the problems of perioperative oral function management in patients with chemotherapy by retrospectively examining cases of oral bacteria detected in blood cultures obtained during chemotherapy. Oral bacteria were detected in 71 patients in 5 years, based on blood culture tests. Oral bacteria were detected in 33 (46%) of 71 chemotherapy patients, which was the most frequent ratio, and oral bacteria were detected in 9 (27%) of 33 patients in the POMF intervention/incomplete group. In the intervention/incomplete group, cases of intervention after the appearance of oral symptoms such as pericoronitis of the wisdom tooth were also observed.

An adverse event with chemotherapy developed with the intervention of oral function management after chemotherapy initiation; therefore, there were an insufficient number of patients for whom we could conduct only oral care. It may be that an intervention before chemotherapy initiation is important to produce the maximum effect of perioperative oral function management.

Our study proved that an intervention before chemotherapy initiation inhibited the detection of oral bacteria in predominance, compared to an intervention after chemotherapy initiation. This finding indicated that a high effect was obtained in our department when we conducted perioperative oral function management for chemotherapy patients, as scheduled. No patient had any further intervention of perioperative oral function management (such as periodontal treatment, infection nest removal, and oral care before chemotherapy initiation) or intraoral problems, other than oral mucositis.

The oral bacteria detected are most often *Streptococcus* mitis and Streptococcus oralis, which accounted for two-thirds of cases. Streptococcus mitis and Streptococcus oralis are endocarditis-causative organisms and are the oral bacteria that bring about bacteremia and sepsis [12]. In addition, bacteremia can be produced without an intraoral infection focus [13]. It may be important to control the intraoral bacterial count so that these bacteria do not cause opportunistic infections during the chemotherapy period [14]. Other detected bacteria involve cariogenic bacteria and periodontal pathogenic bacteria. Controlling caries and periodontal disease before initiating chemotherapy may be important.

Among cases of oral bacteria, 24 (73%) of 33 patients were in the POFM nonintervention group. From April 2012 to March 2015, the intervention rate of POFM for the chemotherapy patients was 21%. Whenever we started POFM and repeated the year, the number of requests for POFM increased and the initial diagnosis of the number of patients increased. However, problems due to the low intervention rate were highlighted. As a solution, patients admitted to our hospital for their cancer therapy appointments is to build a system to be admitted to all patients our department, it was to operate. In this study, the detection of oral bacteria in blood culture tests during chemotherapy indicated that intervention by the appropriate POFM before chemotherapy initiation was necessary. To date, the intervention and the intervention time of POFM depended on the intent of the chief physician in this hospital; however, the intervention of all patients will establish an enabled system in the future and will provide high-quality medical care.

Conclusions

POFM of both suitable methods and the appropriate time has an important role in completing chemotherapy.

Ethics Approval

The study was approved by the ethical committee of Miyazaki University (No, 2015-177).

Competing Interests

The authors declare that they have no competing interests.

Author's Contributions

YK: writing the manuscript, Study design, KA: investigate result of blood culture tests, YT, TT, TK, YS: performing of POFM, YY: supervising the whole project, final approval of manuscript.

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Abbreviations

POFM: perioperative oral function management

Conflicts of Interest

None

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