Published in final edited form as:

Oral Surg Oral Med Oral Pathol Oral Radiol. 2018 April ; 125(4): 286–294. doi:10.1016/j.oooo.2017.12.022.

Transient bacteremia induced by dental cleaning is not associated with infection of central venous catheters in patients with cancer

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Abstract

Objective—To determine incidence of bacteremia from a dental cleaning, and subsequent established blood stream infection (BSI) caused by oral microorganisms, in cancer patients with central venous catheters (CVC).

Study Design—Twenty-six cancer patients with CVCs, and absolute neutrophil count (ANC) over 1000 cells/μl, received dental cleaning without antibiotic prophylaxis. Periodontal status was assessed at baseline using Periodontal Screening and Recording (PSR) score. Blood cultures were drawn via CVC at baseline, 20 minutes into cleaning, and 30 minutes and 24 hours after cleaning. Medical records were monitored for 6 months.

Results—Baseline blood cultures were negative in 25 subjects. Nine of 25 subjects (36%) had positive blood culture 20 minutes into cleaning, all associated with at least 1 microorganism typically found in the mouth. These 9 subjects had significantly higher mean PSR score (3.22) compared to the other 16 (2.56; $p=0.035$). These expected bacteremias did not persist with no positive blood cultures (0/25) at 30 minutes and 24 hours after cleaning ($p = 0.001$). There were no cases of CVC infection or BSI attributable to dental cleaning.

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Disclosures

Conflicts of Interest: None. PDT probes were provided by Zila Pharmaceuticals.

Conclusions—Bacteremias following a dental cleaning are transient and unlikely to cause CVC infection or BSI in patients with ANC over 1000 cells/ μ L.

Introduction

Patients with cancer require frequent administration of intravenous fluids, medications, chemotherapy agents, and blood products during treatment. Adequate venous access is required for efficient, safe, and comfortable delivery of these products. A central venous catheter (CVC) is a thin, flexible tube that is inserted through a vein and advanced to rest in the chest portion of the superior vena cava. CVCs can be divided into two groups: (i) peripherally inserted central catheters (PICC) and (ii) implantable ports with reservoirs. CVCs are used in cancer patients for prolonged periods of time to reduce the discomfort associated with repeated peripheral venous access and to ensure accurate venous delivery of therapeutic agents. Long term CVC use is associated with an increased risk of infection.^{1, 2} However, the benefits of CVC use generally outweigh the risks, and it significantly improves the quality of life of the patient receiving treatment.

Professional dental care plays an important role in oncology patients by preventing and managing oral complications before, during, and after cancer therapy.³ Dental manipulation, including professional dental procedures such as a dental cleaning, can result in the introduction of oral bacteria into the blood stream.⁴ It has been theorized that bacteremia resulting from dental procedures may lead to bacterial seeding of the CVCs in cancer patients and cause blood stream infections (BSIs). Based on this concern, patients with CVCs are often prescribed antibiotic prophylaxis prior to invasive dental procedures. However, a systematic review on this topic by Professor Lockhart's group reported that there were no clinical studies reporting the incidence and natural history of bacteremia or BSI in cancer patients with indwelling CVCs.⁵ In addition, the systematic review found no documented cases of a catheter-related infection associated with an invasive dental procedure. Our review of the literature also found no clinical data on this topic. Despite this gap in knowledge, there are multiple recommendations (based on expert opinion) suggesting the possible need for antibiotic prophylaxis for these patients before invasive dental procedures.^{6–8} Therefore, there is a pressing need for clinical studies examining the relationship of bacteremia resulting from invasive dental procedures with subsequent BSI in cancer patients with indwelling CVC's. The objective of this study was to determine the incidence of bacteremia resulting from a dental cleaning (without antibiotic prophylaxis) and subsequent established BSI caused by oral microorganisms in cancer patients with a CVC, and ANC over 1000 cells/ μ L.

Materials and Methods

Study Design

This was a prospective, single-center, cohort study conducted in the Dental Clinical Research Center at University of Connecticut Health (UCH) in Farmington, CT, USA. [ClinicalTrials.gov](https://clinicaltrials.gov/ct2/show/study/NCT00798330) Identifier NCT00798330.

Protection of Human Subjects

We received institutional IRB approvals and conducted the study in accordance with the Declaration of Helsinki. All subjects provided written informed consent prior to participation. The informed consent process and form clearly explained the potential risk of bacteremia and subsequent CVC infection or BSI resulting from the dental cleaning. Guidelines were in place to ensure that positive blood culture results were promptly relayed to a healthcare professional and a specific protocol followed to ensure patient monitoring, safety, and well-being (described below).

Participants

Twenty-seven subjects were recruited from patients with CVCs receiving oncology care at UCH in the period from March 2009 through May 2012. Subjects were enrolled by an IRB-approved member of the study team, either a Registered Dental Hygienist (RDH) or Registered Nurse (RN). Inclusion criteria were: 18 years old or older, diagnosed with cancer, having a CVC, dentate, willing to provide written informed consent for study participation; absolute neutrophil count (ANC) of at least 1000 cells per microliter (μ l) and a minimum platelet count of 50,000 per μ l for patients who had received chemotherapy within 14 days before the date of the dental cleaning. Exclusion criteria were: Patients who used topical antibacterial agents in the oral cavity or systemic antibacterials within 48 hours of enrollment, patients who had a documented BSI within one month prior to the dental cleaning procedure; those with significant coagulation disorders or taking warfarin; patients who required antibiotic prophylaxis for infective endocarditis per the American Heart Association (AHA) guidelines; or with any other condition which might preclude participation in the opinion of the patient's physician or the study investigators. Subjects refrained from oral hygiene procedures, eating, or drinking in the hour before the dental cleaning procedure and the final blood cultures to reduce risk of bacteremia due to such activities.

Interventions and Outcome Measurements

A schema of the clinical interventions is shown in Figure 1. Subjects in oncology treatment at the time of participation were scheduled for a routine dental cleaning procedure on the day before their next scheduled infusion to maximize ANC and platelet status and to coordinate the final blood cultures with CVC access for clinical care. Subjects completed screening procedures and provided medical history and vital signs before the CVC was accessed on the date of dental cleaning. The CVC was accessed by the study RNs or by oncology nurses from the Neag Comprehensive Cancer Center, before dental procedures were initiated. In all cases, chlorhexidine was topically applied at the CVC site prior to access, per standard of care. Blood was drawn via the CVC for blood cultures using Bactec Plus Aerobic/F and Bactec Lytic 10 Anaerobic/F culture bottles, following standard UCH nursing procedures.

All measurements of gingival and periodontal health, as well as all dental cleanings were performed by a single dental hygienist. Gingival health was recorded using the Gingival Index of Loe and Silness (GI) and periodontal health was measured using the Periodontal Screening and Recording (PSR) scale using a Zila PDT plastic periodontal probe.^{9, 10}

Timing of the dental cleaning began as the periodontal probe initially entered the sulcus of the first tooth evaluated for PSR. Following PSR, sub- and supragingival scaling using hand and ultrasonic instruments was initiated in the sextant with the highest recorded PSR index score. At the 20 minutes into the dental cleaning timepoint, dental cleaning was interrupted and a second set of blood cultures was drawn from the CVC by the RN. Once blood for blood cultures had been drawn, the dental cleaning resumed until a maximum time of 60 minutes elapsed from initial sulcular entry to last contact with the gingiva (including polishing and post-cleaning dental flossing). Subjects then remained on-site for 30 minutes after the cleaning to have a third set of blood cultures drawn from the CVC (30 minutes post-cleaning time point) and to have the CVC de-accessed (port) or capped (PICC), completing study procedures for Visit 1.

Subjects returned for Study Visit 2 on the following day for a final set of blood cultures to assess for bacteremia at the 24 hours from the start of the dental cleaning time point. At this visit, vital signs were again collected to confirm that there were no signs/symptoms of BSI at the time of the visit. Subjects were provided with a handout listing the symptoms of BSI and contact information for the study physicians. They were instructed to contact the study physicians immediately for assessment if they experienced any of the listed symptoms within two days following the dental cleaning.¹¹⁻¹³

Blood cultures were processed by the John Dempsey Hospital Clinical Laboratory, on site at UCH. The Bactec blood cultures used in this study are also used in clinical care at UCH. Positive results from blood cultures were reported by phone to the designated physician and study coordinator for evaluation and management with results posted in the participant's electronic medical record. Protocol was established to have organism identification and sensitivities performed on any positive cultures at the 30 minutes post-cleaning or 24 hours from start of cleaning time points.

The study RNs reviewed all available subject medical records (both inpatient and outpatient records) at the 30 days $\pm$ 3 days and 6 months $\pm$ 7 days post-cleaning time points for occurrence of BSI, with signs/symptoms, duration, and treatment of BSI recorded. BSI was defined as presence of bacteria in the blood stream proven by growth in blood culture, accompanied by one or more of the following: presence of fever (>101 degrees Fahrenheit), chills (patient feeling cold accompanied by shivering), or decreased blood pressure (systolic pressure less than 90 mm of Hg).

Sample Size

This study is focused on the estimation of incidence rates; the goal in sample size calculation was to keep the standard errors of the rate estimates reasonably small. The benchmark that was chosen to achieve this goal was to keep standard errors for the cumulative incidence rates at 20 minutes, 30 minutes after the cleaning, and 24 hours from start of cleaning, at or below $\pm$ 10%. The established formula for the standard error of an estimated proportion allows one to determine that a sample of 25 subjects would be sufficient for this purpose.

Statistical Analyses

The goal of the study was to estimate the incidence of bacteremia and BSIs by oral microorganisms following an invasive dental cleaning in cancer patients with CVCs and meeting the eligibility criteria as listed. Using serum from the baseline blood draw, we made an initial determination of the presence of bacteremia in blood drawn through the CVC. The prevalence of bacteremia at baseline was estimated by calculating the proportion of patients who test positive for oral microorganisms in blood drawn through the CVC at that time. The proportion was reported with an exact binomial 95% confidence interval. The exact confidence interval carries the benefit of maintaining 95% coverage of the “true” prevalence of bacteremia in this clinical population even if the observed number of infected individuals at baseline is zero.

Individuals who tested positive for bacteremia at baseline were excluded from calculation of the incidence of bacteremia at 20 minutes after initiation of cleaning, at end of cleaning + 30 minutes, and 24 hours after initiation of the dental cleaning per protocol. The reason for this exclusion is that such individuals are no longer “at risk” of developing incident bacteremia once the dental cleaning begins.

Incidence rates for bacteremia were calculated for 20 minutes after starting the cleaning, 30 minutes after finishing the cleaning, and 24 hours after the time of dental cleaning initiation by calculating the proportion of individuals who are found to have become bacteremic at each of those time points. Incidence rates are reported with exact binomial 95% confidence intervals.

The incidence of BSI with oral microorganisms during the 30 days following a dental cleaning was estimated by calculation of an incidence density. As in estimating the incidence of bacteremia, any individual who was bacteremic with oral microorganisms at baseline was excluded from the incidence density calculation. The rationale for this exclusion is that it allowed us to capture incidence of BSI that was specifically related to bacteremia that developed through a dental cleaning and not through any pre-existing bacteremia. An incidence density was calculated instead of a cumulative incidence rate because it accounts for variation in the times at which BSIs are detected and for variation in the lengths of the disease-free follow-up periods for such subjects. The incidence density is reported in conjunction with an exact Poisson 95% confidence interval.

Results

Sample Characteristics

Twenty-seven subjects were enrolled to this study. One enrolled subject passed away due to pneumonia in the period between informed consent and the planned date of the study visit. One subject presented at baseline with a subclinical bacteremia detected by study blood cultures taken before the dental cleaning. This finding was promptly communicated to the oncologist and the subject’s PICC was subsequently removed. This subject was removed from post-procedure analyses, resulting in 25 evaluable completed subjects. Table 1 presents the demographics and other characteristics of the 27 enrolled and 25 evaluable subjects.

Bacteremia before, during, and after the dental cleaning—Since 1 of the 26 subjects tested at the baseline study visit presented with a subclinical bacteremia, the prevalence of bacteremia at baseline in 26 enrolled subjects was 4% [95% CI 0–11%]. This subject was removed from post-procedure incidence analysis since she was no longer ‘at-risk’ of developing bacteremia from the dental cleaning. At 20 minutes into the dental cleaning, 9 of the 25 evaluable subjects had a positive blood culture (Table 2), providing a bacteremia incidence rate of 36% [95% CI 17–55%]. All 9 positive cultures at this time point identified at least one microorganism listed in the Human Oral Microbiome Database (HOMD), which lists all microorganisms known to be identified from the oral cavity.¹⁴ Two subjects had two cultured microorganisms each; one subject with two HOMD organisms and one with an HOMD organism and *Clostridium butyricum* (Table 3). The mean duration of the dental cleaning was 54 minutes for the 9 subjects who developed bacteremia at 20 minutes into the cleaning and 56 minutes for the 16 subjects who did not develop bacteremia at this time-point ($p = 0.55$). The mean ANC was 3875 cells/ μ l for the 9 subjects who developed transient bacteremia and 3845 cells/ μ l for the 16 subjects who did not develop transient bacteremia ($p = 0.97$).

At 30 minutes after completion of the dental cleaning, all 25 subjects had negative blood cultures (Table 2), yielding an incidence rate of 0 at this time point ($p = 0.001$ for comparison to incidence at 20 minutes into the cleaning). Thus, cultures from the 9 subjects positive for bacteremia at 20 minutes into the dental cleaning became negative by 30 minutes after the cleaning. Furthermore, none of the 14 subjects whose cultures were negative for bacteremia at 20 minutes into the cleaning became positive at 30 minutes after the cleaning.

At 24 hours after the start of the dental cleaning, blood cultures were negative for all 25 evaluable subjects (Table 2), again demonstrating a bacteremia incidence of 0 at this time point ($p = 0.001$ for comparison to incidence at 20 minutes into the cleaning).

CVC infection and Blood Stream Infection within 30 days—None of the 25 evaluable subjects developed a CVC infection or BSI within 30 days after the dental cleaning (Table 2). Therefore, incidence of post-dental cleaning CVC infection and BSI was 0 with an incidence density of 0 per 1000 catheter-days.

CVC infection and Blood Stream Infection within 6 months—Subjects were followed for a mean of 171 (SD=26.83) days after the dental cleaning. Four subjects succumbed to cancer before reaching the final record review time point. One subject had the CVC removed 78 days after the dental cleaning because their chemotherapy was completed. Data from all evaluable subjects were included in incidence density analysis until the first of the following events occurred: death, removal of the CVC or development of BSI. One of the 25 evaluable subjects experienced a port infection and associated BSI (with *Staphylococcus aureus*) within 6 months after the dental cleaning (Table 2), resulting in a BSI incidence rate of 4% [95% CI 0–12%] at the 6 month post-cleaning time point. This translated into an incidence density of 0.23 BSI per 1000 catheter-days [95% CI 0.00 – 1.60%]. The one BSI event occurred 140 days after the dental cleaning. The subject who developed the BSI had not demonstrated bacteremia at any of the tested study time-points,

including at 20 minutes into the dental cleaning or at the end of the dental cleaning. Blood cultures, collected as an inpatient at the time of the BSI, identified the microorganism as *Staphylococcus aureus*.

Relationship of oral health to bacteremia during the dental cleaning—The mean Gingival Index score (measuring gingival inflammation) was 0.99 [SD=0.487] for subjects who did not develop bacteremia during the dental cleaning and 1.21 [SD=0.682] for those who did develop bacteremia during the dental cleaning, with a higher score indicating more gingival inflammation. However, this difference was not statistically significant ($p=0.35$).

The mean highest recorded PSR sextant score (measuring periodontal disease) was 2.56 [SD= 0.727] for subjects who did not develop bacteremia during the dental cleaning and 3.22 [SD=0.667] for those who did develop bacteremia during the dental cleaning, with a higher score indicating greater severity of periodontal disease. This difference was statistically significant ($p=0.035$).

Discussion

Long-term CVCs limit discomfort that repeated venipuncture would cause to cancer patients and are used in more than two-thirds of adult cancer patients.^{15, 16} The use of CVC's poses a risk of CVC infection and associated BSI which has been reported to be 1.4 – 2.2 infections per 1000 catheter days.¹⁷ These infections are treated for 7 to 21 days and often lead to removal of the CVC. The most common cultured organisms in descending order are: coagulase negative staphylococci, *Staphylococcus aureus*, fungi (mainly *Candida* species) and anaerobic organisms.¹⁸ These organisms can come from four sources: the skin, the tunneled hub of the catheter under the skin, contaminated intravenous fluid and through the bloodstream (from another site in the body).

Since the oral cavity is home to an abundant number and variety of microorganisms, and has a rich blood supply, any physical manipulation in the oral cavity has the potential to introduce microorganisms into the blood stream. This includes both routine daily activities as well as some professional dental procedures. Incidence of bacteremia reported for daily activities include: 20–68% from tooth brushing or flossing, 20–40 % from use of wooden toothpicks and 7–51% from chewing.^{19–22} Incidence of bacteremia reported for different dental procedures include: 10–100% for tooth extraction, 36–88 % for periodontal surgery, 8–80% for scaling and root planing, 9–32% for rubber dam matrix/wedge placement, 40% for teeth cleaning and up to 20% for endodontic procedures.^{23–28} Thus, bacteremia is a common phenomenon during manipulation of the teeth and gums, with more invasive procedures generally associated with a greater risk of bacteremia. However, in most cases, this reported bacteremia is transient and may be of little clinical significance.

Due to the potential for invasive dental procedures to result in bacteremia, there has been a long-standing theoretical concern about such bacteremias leading to infection at distant sites. The most prominent example of this is concern about infective endocarditis. For several decades, patients with a number of cardiac conditions have received prophylaxis with antibiotics prior to invasive dental procedures, per guidelines of the American Heart

Association (AHA) and American College of Cardiology (ACC). Recently, these guidelines have undergone significant changes and now recommend prophylaxis against infective endocarditis prior to dental treatment only in a very limited number of situations (selected cardiac pathology, artificial valves, or history of infective endocarditis).²¹ These revisions followed a consensus from the panel about the lack of evidence supporting this practice and the negative consequences of indiscriminate antibiotic use. An AHA Scientific Statement on non-valvular cardiovascular device-related infections (released in 2003) also concluded that there was a lack of convincing evidence to support antibiotic prophylaxis before invasive dental procedures in patients with such devices.²⁹ However, this statement did not specifically address CVC's and risk of BSI associated with such devices.

There are no current evidence-based guidelines on antibiotic prophylaxis for dental procedures in cancer patients with CVCs. A 2011 guideline from the Centers for Disease Control (CDC) recommends that systemic antimicrobial prophylaxis should not be used routinely before insertion or during use of an intravascular catheter to prevent catheter colonization or catheter-related blood stream infection; however this guideline does not specifically address prophylaxis prior to invasive dental procedures.³⁰ A systematic review on this topic by Hong et al. reported that no evidence exists to support use of prophylactic antibiotics for dental procedures to prevent CVC infection and no documented cases of CVC infections related to oral procedures have been reported.⁵ The Oral Care Study Group of the Multinational Association of Supportive Care in Cancer and International Society of Oral Oncology (MASCC/ISOO) conducted an international survey of cancer centers around the world. When asked about the use of antibiotic prophylaxis before dental procedures in patients with cancer who had indwelling CVCs: 57% responded yes, they recommend this practice; 23% responded no, they do not; and 20% stated that they did not know how this was managed at their center.³¹ Such variation and the current opinion-based practice can be attributed to the lack of clinical data, which prompted us to undertake this study.

In this study, we documented positive blood cultures in 9 of 25 subjects (36%) at 20 minutes into the dental cleaning (without antibiotic prophylaxis). This is consistent with a previous report of a 40% incidence of bacteremia from dental cleaning procedures.³² All 9 of these positive blood cultures included at least one microorganism known to be present in the human oral cavity. Furthermore, subjects who experienced a bacteremia had significantly worse periodontal disease than subjects who did not have a bacteremia. These findings support the interpretation that these expected bacteremias were likely caused by the dental cleaning. The time points for blood cultures were selected on the basis of prior studies that have identified that bacteremia after a dental procedure can occur as early as 30 seconds after initiation of the procedure and may persist for up to 30–60 minutes.^{33, 34} The time point at 24 hours from the start of the dental cleaning was selected to evaluate for persistent bacteremia or to identify bacteremia generated from seeding of the CVC by oral microbes introduced during the dental cleaning. Importantly, there was not a single documented bacteremia at 30 minutes after the end of the dental cleaning and at 24 hours after the cleaning. These results demonstrate with statistical significance that bacteremia induced by the dental cleaning was transient and did not lead to post-procedure bacteremia from microbial seeding of the CVC during the dental cleaning. Furthermore, during the 6 month followup, there were no CVC infections or BSIs attributable to the transient bacteremia

induced by the dental cleaning. The one case of BSI occurred 140 days after the dental cleaning in a subject who did not have a positive blood culture during or after the dental cleaning. The causative organism was *Staphylococcus aureus*, which is much more abundant on the skin than in the oral cavity, and is one of the most common causes of nosocomial CVC infection.³⁵ Since it was not cultured during or after the dental cleaning, this infection can be concluded to have occurred through subsequent regular oncology use of the CVC for treatment needs. Thus, our data demonstrate that while dental cleanings in cancer patients with CVCs can lead to a bacteremia, this bacteremia is transient and is not associated with risk of CVC infection or BSI, in patients with ANC over 1000 cells/ μ l.

Strengths of this study include the prospective study design. This is the first study, to our knowledge, to prospectively examine the incidence of bacteremia and risk of CVC infection and BSI following a dental procedure in cancer patients. The intervention was highly standardized with the dental cleanings all carried out by the same dental hygienist and timed to last for close to 60 minutes. Collection of blood samples at baseline and time-points during and after the cleaning allowed the determination of exactly which bacteremias occurred due to the dental cleaning (as opposed to preexisting bacteremia). Subjects also did not engage in oral activities that may induce bacteremias for at least one hour prior to the blood sample collections. Furthermore, patients using any topical (in the oral cavity) or systemic antimicrobials, in the preceding 48 hours, were not eligible. This provides further confidence that bacteremias occurring due to the dental cleaning were appropriately identified. Limitations of the study include the relatively small sample size, which weakens the strength of the incidence estimates and must be taken into account when interpreting the results. However, this sample size was adequate to demonstrate a strong statistically significant difference between the incidence of bacteremia at 20 minutes into the cleaning and the subsequent time-points ($p = 0.001$). Our sample consisted mainly of patients with ports and only 1 patient with a PICC. The type of CVC should not affect the occurrence of bacteremia due to the dental cleaning, although it could have an impact on the potential for CVC infection and BSI. The identification of bacteremias was based on standard blood culture methods, which are not as precise as molecular techniques such as DNA sequencing.³⁶ However, the technique used by us is the standard of care in most hospital laboratories and is used clinically for speciation and to inform treatment selection.

There are a number of possible confounders that can influence the risk of bacteremia after a dental cleaning. A patient with few teeth may have a lower risk of bacteremia from a dental cleaning than a fully dentate patient. While we did not specifically record the number of teeth each patient had, our records indicate that most of the patients had the majority of their teeth. This is based on records of scoring of periodontal disease by sextant. Out of 150 sextants in 25 evaluable subjects, only 4 sextants were not able to be scored due to lack of any teeth in that sextant. Another possible confounder, related to the number of teeth, is the duration of the dental cleaning. In our study, the mean duration of the dental cleaning was very similar for the 9 subjects who developed bacteremia at 20 minutes into the cleaning and the 16 subjects who did not develop bacteremia at this time-point. The immune status of patients can also affect their risk of bacteremia. Of the 25 evaluable subjects, the mean ANC for the 9 subjects who developed transient bacteremia was very similar to that of the 16 subjects who did not. As expected, the mean ANC was somewhat lower for the 18 patients

still receiving cancer treatment, as compared to the 7 subjects who had already completed cancer treatment, although this difference was not statistically significant. To ensure subject safety, we excluded patients who were highly immunosuppressed and/or at higher risk of bleeding (ANC below 1000 cells/ μ l and platelet count below 50,000 cells/ μ l). This limits the generalizability of these findings for such patients. Cancer therapy can lead to changes in the oral flora, although a recent systematic review from MASCC/ISOO reported that oral colonization with *Streptococcus mutans* and *Lactobacilli* remained unchanged or decreased during anti-neoplastic chemotherapy (Level of Evidence: III).³⁷ There are concerns about the health risks and cost-effectiveness of antibiotic prophylaxis in the general population.^{38–40} Amoxicillin, which is the first line antibiotic used for prophylaxis, can be associated with allergic reactions ranging in spectrum from simple skin rashes to Stevens-Johnson syndrome to fatal anaphylaxis. However, a recent study examining the use of single-dose amoxicillin as prophylaxis against infective endocarditis found only 22.62 non-fatal reactions per million prescriptions and no fatal reactions in almost 3 million prescriptions.⁴¹ There are also increasing reports about the emergence of antibiotic resistance even in patients presenting with infections that are community-acquired.⁴² The economic cost to society associated with widespread prophylaxis with antibiotics is another issue.⁴³

Some studies have reported that antibiotic prophylaxis before a dental procedure in the general population reduces the incidence of bacteremia.^{38, 44} There are no studies to suggest that this intervention eliminates bacteremia or reduces the incidence of established BSIs in cancer patients with CVCs.⁵ Our findings demonstrate that, in patients with ANC greater than 1000 cells/ μ l, bacteremia induced by dental cleanings is transient and is not associated with risk of CVC infection or BSI. These findings do not support the need for routine antibiotic prophylaxis for invasive dental procedures in such patients.

Acknowledgments

The authors gratefully acknowledge the contributions of the subjects who participated in this study, study nurses Kathleen Curley, RN and Susan Walters, RN, and clinical oncology nurses in the Neag Comprehensive Cancer Center. We also thank Cynthia Rybczyk, RDH and Jennifer Gibbs, RDH, MS for valuable contributions to data analyses and manuscript formatting.

This study was supported by the Neag Comprehensive Cancer Center at UConn Health and by NIH grant M01 RR006192 awarded to the University of Connecticut Clinical Research Center.

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Statement of Clinical Relevance

Transient bacteremias following dental cleaning did not lead to central venous catheter infection or blood stream infection in cancer patients with ANC over 1000 cells/ μ l. These findings do not support routine antibiotic prophylaxis for dental procedures in such patients.

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Day 1 **Day 2**

Figure 1.
Schema of Clinical Interventions

Table 1

Characteristics of Study Subjects

	All Subjects (n=27)		Evaluable Subjects (n=25)	
Age (years)	50.41 (SD 15.20)		50.21 (SD 15.67)	
	Number	%	Number	%
Gender				
Male	7	26	7	28
Female	20	74	18	72
Central Venous Catheter Type				
PORT	25	93	24	96
PICC	2	7	1	4
Cancer Diagnosis				
Breast	10	37	9	36
Gastrointestinal	7	26	7	28
Hodgkin's Lymphoma	4	15	4	16
Other (1 each)	6	22	5	20
Chemotherapy Status (mean ANC)				
In treatment	20 (3624)	74	18 (3618)	72
Treatment completed	7 (4469)	26	7 (4469)	28

PICC = Peripherally Inserted Central Catheter

ANC = Absolute Neutrophil Count, cells/ μ l

Blood Culture Results and Documented Blood Stream Infection (BSI) for the 25 evaluable study subjects

Table 2

Blood Culture Results	Time point					
	Baseline (before start of dental procedure)	20 minutes into dental procedure	30 minutes after end of dental procedure	24 hours after start of dental procedure	BSI within 1 month after dental procedure (from record review)	BSI within 6 months after dental procedure (from record review)
Positive	0	9	0	0	0	1
Negative	25	16	25	25	25	24
Total	25	25	25	25	25	25

Table 3

Microorganisms identified by blood culture at 20 minutes into the dental procedure

Organism identified by blood culture at 20 minutes into the dental procedure	Oral Microorganism listed in the HOMD?	HOMD Rank Abundance of organism in the oral cavity
<i>Streptococcus mitis</i>	Yes	2
<i>Streptococcus mutans</i>	Yes	3
<i>alpha hemolytic Streptococcus</i>	Yes	3
<i>Viridans streptococcus (either mutans or sanguis)</i>	Yes	3, 4
<i>Fusobacterium species</i>	Yes	11
<i>Streptococcus intermedius</i>	Yes	19
<i>Corynebacterium species</i>	Yes	41
<i>Wolinella species, campylobacter</i>	Yes	98
<i>Prevotella intermedia</i>	Yes	116
<i>Clostridium butyricum</i>	Yes	NA

HOMD = Human Oral Microbiome Database