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Physician compliance with American Heart Association guidelines for prevention of bacterial endocarditis in dental procedures

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Aim: To evaluate physicians' compliance level with the American Heart Association (AHA) 2007 guidelines concerning the management of dental patients at risk for bacterial endocarditis.

Materials and methods: This study included 103 patients with cardiac problems. The mean age was 41.02 ± 15.22 years. According to consultations with physicians, the selection of the antibiotic, the timing, and the dosage were recorded on patients' forms prior to dental procedures by the researchers of the Department of Oral and Maxillofacial Surgery and Department of Oral Diagnosis and Radiology. Physicians' compliance level with the AHA 2007 recommendations was evaluated.

Results: Antibiotic prophylaxis was prescribed for 75 (72.8%) of 103 patients with cardiac problems although it was not indicated. On the other hand, antibiotic prophylaxis was recommended with correct indication for 22 patients (21.3%). Two (9.1%) of these 22 patients were prescribed appropriate antibiotics, with correct dosage and timing by the physicians according to the AHA 2007 guidelines. Amoxicillin (20.0%) and combinations of the antibiotics (20.0%) were the first choices for prophylaxis. No antibiotic regimen was prescribed for 6 patients (5.9%), who did not require antibiotic prophylaxis according to the AHA 2007 guidelines.

Conclusion: Clinicians are not always aware of the current clinical guidelines regarding antibiotic prophylaxis and must be aware of the contemporary guidelines and avoid prescribing excessive antibiotics to prevent emergence of resistant organisms.

Key words: Infective endocarditis, dental procedure, antibiotic, prophylaxis, AHA guidelines

Tıp doktorlarının dental işlem uygulanan hastalarda, bakteriyel endokarditi engellemede Amerikan Kalp Birliği kılavuzlarına uyumu

Amaç: Bu çalışmanın amacı, bakteriyel endokardit riski taşıyan dental işlem uygulanan hastalarda, tıp doktorlarının 2007 Amerikan Kalp Birliği kılavuzuna uyma seviyesini araştırmaktır.

Yöntem ve gereç: Bu çalışma, kardiyak yönden sorunlu 103 hasta üzerinde gerçekleştirilmiştir. Hastaların yaş ortalaması 41,02 ± 15,22 olarak tespit edilmiştir. Dental işlemlerden önce tıp doktorlarından istenen konsültasyona göre, reçete edilen antibiyotik seçimi, zamanlama ve dozaj hasta formlarına Ağız, Diş, Çene Hastalıkları Cerrahisi ve Oral Diagnoz ve Radyoloji Anabilim Dallarındaki çalışmacılar tarafından kaydedilmiştir. Tıp doktorlarının, 2007 Amerikan Kalp Birliği kılavuzundaki tavsiyelere uyma seviyeleri değerlendirilmiştir.

Bulgular: 103 kardiyak açıdan sorunlu hastanın 75'ine (% 72,8) endikasyon olmadığı halde profilaktik amaçlı antibiyotik reçete edilmiştir. Buna karşın, 22 (% 21,3) hastada doğru endikasyonla antibiyotik reçete edilmiştir. Tıp doktorları

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tarafından, 22 hastanın sadece 2'sine (% 9,1) AHA 2007'ye göre, uygun antibiyotik doğru dozaj ve zamanlamada reçete edilmiştir. İlk sırada yer alan antibiyotikler amoksisilin (% 20,0) ve kombine olarak verilenlerdir (% 20,0) . Kılavuza göre profilaksi gerekli olmayan 6 (% 5,9) hastaya antibiyotik reçete edilmemiştir.

Sonuç: Klinisyenler, antibiyotik profilaksisi ile ilgili mevcut klinik kılavuzları her zaman takip etmemektedirler. Güncel kılavuzlar hakkında bilgi sahibi olmalılar ve dirençli organizmaların ortaya çıkmasını engellemek için, gereksiz yere antibiyotik reçete etmekten kaçınmalıdırlar.

Anahtar sözcükler: Enfektif endokardit, dental işlem, antibiyotik, profilaksi, AHA kılavuzları

Introduction

Antibiotic prophylaxis aims to prevent life-threatening infections of blood-borne organisms at a site distant from the cause of the bacteremia. Antibiotic prescription is required for patients with cardiac problems in order to prevent infective endocarditis, which might be the result of bleeding in dental procedures (1).

There are some associations determining the rules about antibiotic prophylaxis, such as French recommendations 2002 (2), British Society for Antimicrobial Chemotherapy (BSAC) 2006 (3), and American Heart Association (AHA) 2007 (4). For the antibiotic prophylaxis in cardiac patients, the American Heart Association's (AHA) guidelines are used. The AHA first published guidelines regarding the prevention of bacterial endocarditis in 1955 (5), and from 1957 to 1997, these guidelines were updated 8 times. In light of these growing concerns, in 2007, the AHA released new guidelines for the prevention of infective endocarditis. The recent 2007 version restricted the list of cardiac conditions for which antibiotic prophylaxis before dental procedures is reasonable (6).

Most of the studies regarding the knowledge of AHA 1997 among dentists and general physicians were survey studies that evaluated the general dental practitioner's and physician's knowledge about the antibiotic prophylaxis (7-14). To the best of our knowledge, there is no prospective study on this topic in the English literature. According to a PubMed search in English, to date, there is only one study regarding the knowledge of the new 2007 AHA guidelines among dentists or physicians (14).

The aim of this study was to investigate the appropriateness of the antibiotic recommendations by the physicians according to the AHA 2007 guidelines for the cardiac compromised patients prior to dental procedures, in the School of Dentistry, Ege University, in Turkey.

Materials and methods

This study was conducted in 103 medically compromised patients who were treated at the Faculty of Dentistry, Ege University, Turkey, from May 2007 to February 2009. Of the patients, 44 were women (42.72%) and 59 were men (57.28%). The mean age was 41.02 ± 15.22 years, ranging from 3 to 81 years. The average age was 39.32 ± 18.60 years for men and 42.44 ± 18.09 years for women.

Dental and medical history was obtained. Clinical and radiological examination findings of the patient and demographic characteristics were recorded at the Department of Oral and Maxillofacial Surgery and the Department of Oral Diagnosis and Radiology. If a dental procedure needing antibiotic prophylaxis was planned, the patient was referred to their physicians for consultation. Reasons for doctor's visit, the patient's systemic disease, the antibiotic recommended by the patient's physician, the dosage of the antibiotic, and dental procedure were recorded. Whether the antibiotic prophylaxis is appropriate or not according to the AHA's guidelines was also recorded. The 2007 AHA guidelines for antibiotic prophylaxis were used as standard.

Subjects were informed with information leaflets and in person about the study and were required to sign a consent form. Research was conducted in accordance with the World Medical Association Declaration of Helsinki.

We entered the data into Microsoft Access 97 (Microsoft Corp.) and analyzed them using SPSS 10.0. Descriptive statistics and graphics were also included.

Results

The reasons for the patients in this study to see the doctor are shown in Figure 1. Most of the patients required tooth extraction (69.3%). This was followed by scaling and root planing (12.4%), treatment for endodontic instrumentation beyond root apex (3.7%), combination procedures (13.1%), and dental implant placement (1.5%). There were 2 combination procedures; the first one was scaling and root planning + treatment for endodontic instrumentation beyond root apex; the second one was tooth extraction + scaling and root planning (Figure 2).

Medical conditions of cardiac compromised patients were as follows: heart valve disease (62.1%), prosthetic heart valve (13.6%), congenital heart disease (12.6%), previous infective endocarditis (3.9%), and other cardiac conditions (7.8%). Other cardiac compromised patients were 3 by-pass, 1 heart transplant, 1 coronary heart disease, and 1 heart insufficiency patients and 2 heart transplant candidates (Figure 3).

For 6 patients no antibiotic prophylaxis was recommended by the patient's physician. Three patients with mitral valve disease (mitral valve prolapse with regurgitation), and 3 patients with aortic stenosis were not instructed to take antibiotics.

An evaluation of the appropriateness of the physician's prophylactic antibiotic recommendation for the cardiac compromised patient showed that 75 of 103 cardiac compromised patients (72.8%) were prescribed antibiotic for prophylaxis although it was not indicated, while 22 patients (21.3%), underwent antibiotic prophylaxis with correct indication. No antibiotic regimen was prescribed for 6 patients (5.9%) who did not require antibiotic prophylaxis according to AHA 2007.

When we evaluated the antibiotics for 22 cardiac compromised patients (21.3%) who were prescribed antibiotics with correct indication, appropriate antibiotics including amoxicillin, ampicillin, clindamycin, cephalexin, azithromycin, and clarithromycin (AHA 2007) were correctly

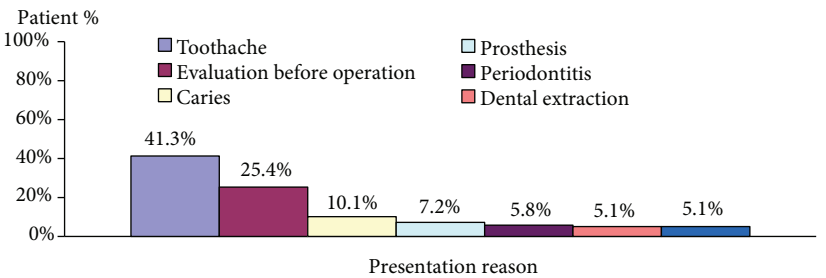

Figure 1. Reason for the medically compromised patients to see the doctor.

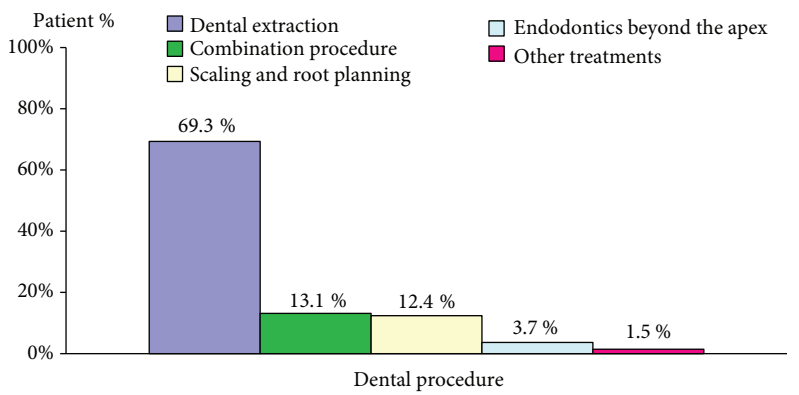

Figure 2. Dental procedure for which antibiotic prophylaxis is used.

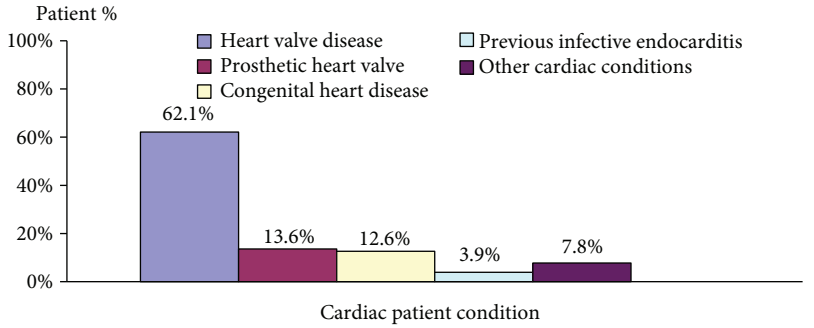

Figure 3. Condition of cardiac compromised patient.

chosen by physicians of the 2 patients (9.1%), while 11 patients (50.0%) were advised an inappropriate antibiotic regimen for prophylaxis. It was found that in 9 (40.9%) of them, the antibiotics were appropriate but the dosage and duration regimen were incorrect. Appropriate drug but incorrect second dosage 6 h after the first dosage regimen was prescribed to 7 of these 9 patients and appropriate drug with long-term use was recommended for 2 of these 9 patients (Figure 4).

When we evaluated the use of antibiotics without considering correct indication in our study, amoxicillin (20.0%) and combined antibiotics (20.0%) were the first choices for prophylaxis, followed by ampicillin (14.6%), ciprofloxacillin (4.6%), and other antibiotics (40.8%) (Figure 5). Combined antibiotics were ampicillin + gentamicin (69.3%), amoxicillin + gentamicin (19.2%), amoxicillin/clavulanic acid + gentamicin (3.9%), amoxicillin + ampicillin/sulbactam (3.8%), and ciprofloxacillin + ampicillin/sulbactam (3.8%). Other antibiotics (40.7%) were bacampicillin, trimethoprim/sulphamethoxazole, vancomycin, azidocillin, teicoplanin, penicillin G-benzathine, azithromycin, clindamycin, ampicillin/sulbactam, cefazolin, clarithromycin, and amoxicillin/clavulanic acid.

Fourteen of the antibiotics prescribed in the present study were not recommended by the AHA 2007. These 14 different antibiotic prophylaxis included ciprofloxacin, bacampicillin, trimethoprim/sulphamethoxazole, vancomycin, azidocillin, teicoplanin, penicillin G-benzathine, amoxicillin/clavulanic acid, ampicillin/sulbactam, ampicillin + gentamicin, amoxicillin + gentamicin, amoxicillin + ampicillin/sulbactam, ciprofloxacin + ampicillin/sulbactam, amoxicillin/clavulanic acid + gentamicin (Table 1).

Six patients (4.6%) were allergic to penicillin. Azithromycin was prescribed for 3. Cefazolin was recommended for 2 patients, and clindamycin for 1 patient (Table 2).

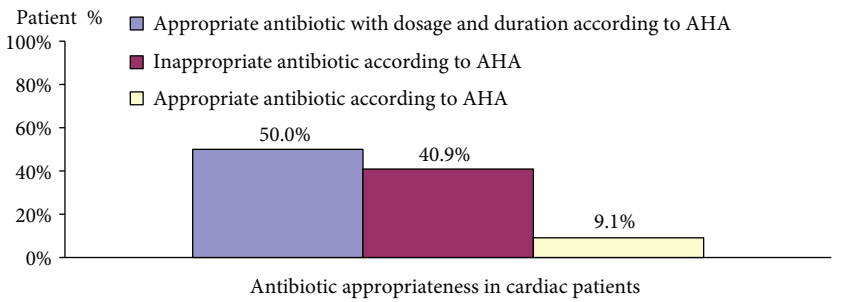

Figure 4. Appropriateness of the prescribed antibiotic for 22 cardiac compromised patients with correct indication.

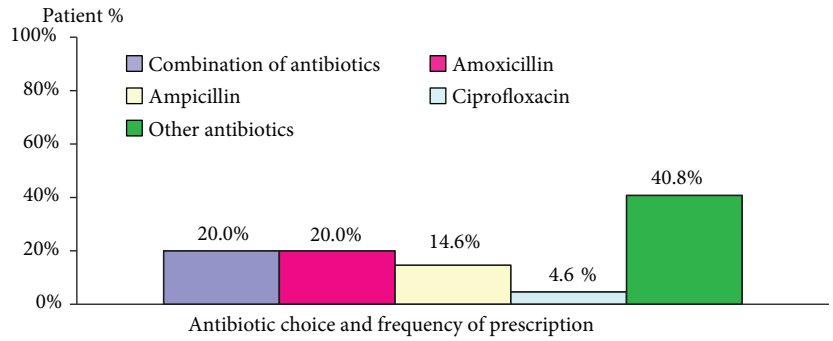

Figure 5. Frequency of the prescribed antibiotic for prophylaxis.

Table 1. Antibiotics prescribed in the present study and the ones recommended by the AHA 2007.

Agents prescribed by the physicians in the present study	Agents Recommended by 2007 AHA Guidelines
Amoxicillin	Amoxicillin
Combined antibiotics*	Ampicillin or
Ampicillin	Cefazolin or
Ciprofloxacillin	Ceftriaxone
Others**	

*Combined antibiotics: Ampicillin + gentamicin, amoxicillin + gentamicin, amoxicillin + ampicillin/sulbactam, ciprofloxacillin + ampicillin/sulbactam, and amoxicillin/clavulanic acid + gentamicin.
**Others: Bacampicillin, trimethoprim/sulphamethoxazole, vancomycin, azidocillin, teicoplanin, penicillin G-benzathine, azithromycin, clindamycin, ampicillin/sulbactam, cefazolin, clarithromycin, and amoxicillin/clavulanic acid.

Table 2. Antibiotics prescribed for the allergic patients in the present study and recommended by the AHA 2007.

Agent prescribed for the allergic patient to penicillin in the present study	Agents recommended by 2007 AHA Guidelines, for the allergic patient to penicillin
Azithromycin	Cephalexin or
Clindamycin	Cefadroxil or
Cefazolin	Clindamycin or
	Azithromycin or
	Clarithromycin

Discussion

Antimicrobial agents have often been the targets of attempts to restrict and control their use because of increasing concern and awareness of antibiotic resistance and inappropriate use of these drugs (15). Therefore, excessive and inappropriate use of antibiotics should be avoided. Excessive and inappropriate use of antibiotics may occur under many conditions. Prescription of the antibiotic for prophylaxis although it is not indicated is common.

Moreover, antibiotics may be prescribed incorrectly by the physician or dentist. Sometimes, the antibiotic is correct but dosage or duration is incorrect.

In our study, physicians' compliance level with the AHA 2007 recommendations was evaluated. After consultations with physicians, the selection of the antibiotic, the timing, and the dosage were recorded on the patients' forms prior to dental procedures at the Department of Oral and Maxillofacial Surgery and the Department of Oral Diagnosis and Radiology.

In the present study, antibiotic prophylaxis applied to the patients, without an indication, was found to be about 72.8%. Antibiotic prophylaxis was correctly prescribed for 22 cardiac compromised patients (21.3%). When the antibiotic regimen was evaluated, correct antibiotics with correct dosage and duration were prescribed in only 2 patients. Nine patients were given the correct antibiotic; however, incorrect second dosage (6 h) was prescribed to 7 patients. A second dosage prescription was claimed to be unnecessary according to the AHA guidelines (5). Appropriate therapy, but incorrect duration, occurred for 2 of the patients.

When we evaluated the patients regarding indication, antibiotic recommendations were found to be in accordance with the AHA 1997 guidelines, rather than the 2007 ones. For example, antibiotic prophylaxis was recommended for 55 patients with heart valve disease. This procedure was appropriate for the AHA 1997 recommendations, while according to the AHA 2007 criteria these patients were not in a risk group and were not recommended to be prescribed any antibiotics regimen (5).

In contrast to our study, Zadik et al. (14) reported that correct response for cardiac conditions was 81.3% (highest failure: mitral valve prolapse [MVP] with regurgitation). Correct antibiotic, dosage, and timing occurred in 99%, 93.8%, and 100% of the respondents, respectively. Additionally, these authors reported that postoperative antibiotic dosage was prescribed by 2.1% of the dentists. However, the knowledge level was lower in studies reported for earlier versions of the AHA guidelines (7,9,16,17) . Boyle et al. (18) reported that cardiologists showed a preference for the AHA guidelines (50%) and dental health education of at risk patients by their cardiologists and dentists is inadequate. Similarly, Palmer et al. (9) found that a significant number of the practitioners surveyed prescribe prophylactic antibiotics inappropriately, both for surgical procedures and for patients at risk of endocarditis. Our findings showed that, similar to previous studies, the antibiotics prescribed for prophylaxis were not appropriate according to the 2007 AHA's recommendations. Combinations of antibiotics were prescribed by 20.0% physicians, although it was not recommended by the AHA.

In a questionnaire study (16), a third of the participants prescribed an unnecessary postoperative dosage. In other studies, data indicated that most of the physicians are prescribing according to earlier AHA (1990) guidelines (17).

In the present study, amoxicillin (20.0%) and combinations of the antibiotics (20.0%) were the first choices for prophylaxis by the physicians, followed by ampicillin (14.6%), ciprofloxacillin (4.6%), and other antibiotics (40.8%). Zadik et al. (14) reported that amoxicillin was prescribed by 99% of the participants as the prophylactic antimicrobial agent. It was determined that 14 different antibiotics, which were not recommended by the AHA, were prescribed for prophylaxis. This finding shows that various kinds of antibiotics were prescribed for prophylaxis. This supports the idea that there is no consensus on the subject of antibiotic prophylaxis.

Although the AHA does not recommend simultaneous use of 2 antibiotics for antibiotic prophylaxis before dental procedures, in the present study a combination of 2 antibiotics were recommended in 26 patients. However, to the best of our knowledge prophylactic prescription of combined antibiotics for cardiac compromised patients has not been reported in the English literature.

Epstein et al. (7) reported that amoxicillin was the most prescribed antibiotic in their study. On the other hand, Lauber's (8) survey results showed that the most commonly prescribed antibiotic was clindamycin (49%), followed by azithromycin, clarithromycin (6%), and cephalexin (5%).

Patients with penicillin allergy may receive cephalexin, clindamycin, or either azithromycin or clarithromycin, instead of erythromycin according to the 1997 AHA's guidelines. In the present study, erythromycin was not prescribed to patients who were allergic to penicillin. Our 6 patients who were allergic to penicillin were prescribed azithromycin,

clindamycin, or cefazolin. In contrast to our finding, in Lauber's (8) study, an incorrect drug, erythromycin, was prescribed by 21% of the physicians to patients who were allergic to penicillin. Zadik et al. (14) found this rate as 1%.

Dentists and physicians are not always aware of the most current clinical guidelines regarding antibiotic prophylaxis, even though guidelines are widely available (8,19). To be unaware of these guidelines may cause overuse of antibiotics, with the attendant risks of toxicity and emergence of resistant strains. It is not clear why they do not prescribe appropriate antibiotics according to current guidelines. Are they really not aware of the current guidelines? Do they prescribe antibiotics according to earlier guidelines, even though they are aware of the current guidelines, due to their habits? As the present study does not address these questions, further studies are needed.

A previous study noted that traditional educational methods, which are passive in nature, have been ineffective to change prescribing behaviors of physicians (20). In addition, human behaviors are complex and involve cognitive processes, such as perception, comprehension, reasoning, decision making, and problem solving (21). Information technology, such as feedback and reminder systems, is an effective method to eliminate inappropriate use of surgical prophylactic antibiotics. Although continuing education programs seem to be less helpful, multiple interventions are still needed to achieve the maximum positive effect (22). In fact, more important than these guidelines, there is a need for improvement in oral health knowledge in this country. Oral health education plays an important role in this improvement, and the primary and secondary schools may provide effective settings for oral health education programs.

Conclusion

Clinicians are not always aware of the current clinical guidelines regarding antibiotic prophylaxis. However, they must be aware of the contemporary guidelines to avoid prescribing excessive antibiotics to prevent emergence of resistant organisms. Efforts to raise awareness of AHA guidelines should be continued, such as evaluating and revising their prescribing habits following an education course.

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