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Abstract- Infective endocarditis (IE) is an infection of the endothelial surface of the heart and heart valves with serious, even fatal complications and that often requires long-term treatment. Many dental procedures may lead to IE in high-risk patients. The aim of the present study was to assess the awareness and knowledge of graduating medical and dental students at Qassim University, KSA regarding prevention of infective endocarditis. A questionnaire was administered to the last year medical and dental students. An acceptable level of success in the test was defined as at least 7 correct answers out of 13 (53%). Out of 118 students participating in this study, 65 (47.4%) passed the test successfully. Although the pass-rate of medical students (45/93 or 48.4%) was comparatively higher than that of dental students (11/25 or 44%) the difference between the two groups was not statistically significant. This study showed that the knowledge concerning prevention of IE among the dental and medical students was moderate and highlighted the necessity of more education in this field.

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I. Introduction

Infective endocarditis (IE) is an uncommon but lifethreatening infection. Despite advances in diagnosis, antimicrobial therapy, surgical techniques and management of complications, patients with IE still have high morbidity and mortality rates related to this condition(1).Endocarditis occurs when bacteria enter the bloodstream (bacteremia) and attach to a damaged portion of the inner lining of the heart or abnormal heart valves [(2).]

Viridans streptococci causes approximately 60% of cases of native valve endocarditis and dental manipulation have been repeatedly considered as a source of bacteremia that leads to IE[(3).] One study reported that 10% to 20% of patients with IE caused by oral flora underwent a preceding dental procedure[(4)] .The evidence linking bacteremia associated with a dental procedure with IE is largely circumstantial, and the number of cases related to a dental procedure is overestimated for a number of reasons (1). The American Heart Association (AHA) published regularly updated guidelines that emphasized the association between dental procedures and IE and recommended antibiotic prophylaxis [(1).]

The AHA has been recommending for the prevention of IE for more than 55 years. The first AHA document on the subject been published in In 1955 [(5).]

Infective endocarditis is taught to all dental and medical students as a part of their curriculum and they must be familiar with the latest AHA recommendations on the prevention of IE. However, several studies have showed low compliance with AHA guidelines for prevention of IE, lack of knowledge at a reasonable level in this field among dental and medical students and practitioners, and the need for improved education regarding AHA guidelines [(6) (7) (8) (9).]

Study about dentists' and dental students' knowledge of the newest guidelines for antibiotic prophylaxis for high-risk patients in dentistry and the correct application of these guidelines in different regions is very important [(10).]

Considering this, it is critical that all dental and medical students have an up-to-date and reasonable knowledge about cardiac lesions and invasive procedures that predispose patients to the development of IE and prophylaxis regimens recommended by AHA for prevention of this disease.

The aim of the present study was to assess of awareness and knowledge of graduating medical and dental students at Qassim university, KSA regarding prevention of infective endocarditis.

II. Materials and Methods

This survey was conducted using a structured questionnaire having multiple-choice questions based on the last AHA recommendations (2007) about the prevention of IE.The questionnaire validated by previous studies [(6) (10).] The questionnaire consisted the following:

- Part I: personal data which including gender and college.

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- Part II: three multiple - choice questions about the causative bacteria and underlying cardiac conditions that predispose patients to IE.
- Part III: three multiple-choice questions about commonly performed dental procedures, oral cavity as a possible source of bacteremia and the safety of electric powered toothbrushes in susceptible patients.
- Part IV: seven multiple-choice questions about the type of antimicrobial prophylaxis to be prescribed for "at risk" patients before invasive dental procedures.

The questionnaire was distributed to 137 Graduating medical and Dental Students at Qassim University, KSA from 5th to 12th January 2013. 118 filled questionnaires were returned giving a response rate of 86.1%. The data was analyzed using SPSS 16 program for descriptive statistics. Chi-square was used to compare the medical and dental student with regard to there knowledge. The α level for the statistically significant result was $p>0.05$.

III. Results

44.1% or respondents were male medical students, 34.7% were female medical students and 21.2% were male dental students (Table 1).

Table 1 : No. and Percentage of Distributed & Returned Questionnaire in each College

College	Sex	NO. of distributed Q.	NO. of returned Q.	Perc. of returned Q.
Medicine	Male	65	52	44.1%
	Female	44	41	34.7%
Dentistry	Male	28	25	21.2%
Total		137	118	100%

An acceptable level of success for the test was defined as at least 7 correct answers out of 13 (53%). Of 118 students participating in this study, 65 (47.4%) of them passed the test successfully. The pass-rate of medical students (45/93 or 48.4%) was higher than that of dental students (11/25 or 44%).

Regarding the question, about cardiac condition in which the risk of occurrence of infective endocarditis is higher than others, 51.6% of medical students and 32% of dental students were able to recognize that Prosthetic heart vale is the correct answer. The chi-square test showed no significant difference between the knowledge of the medical and dental students $p= 0.132$ (Table 2).

Table 2 : Cardiac Condition in which the Risk of Occurrence of Infective Endocarditis is Higher than others

College	Prosthetic heart vale *	Previous infective endocarditis	Tetralogy of Fallot	Mitral stenosis	N	P
Medicine	51.6%	19.4%	14%	15%	93	0.132
Dentistry	32%	16%	32%	20%	25	
* the correct answer of the Question						

35.5% of medical students and 30% of dental students correctly chose Mitral valve prolapse without regurgitation as the cardiac condition in which there is a lower or negligible risk for developing infective endocarditis. The difference was not statistically significant $p= 0.575$ (Table 3).

Table 3 : Cardiac Condition in which there is a Lower or Negligible Risk for Developing Infective Endocarditis

College	Mitral valve prolapse without regurgitation *	Surgically constructed systemic-pulmonary shunts	Ventricular septal defect	Coarctation of aorta	N	P
Medicine	35.5%	12.9%	26.9%	24.7%	93	0.575
Dentistry	30%	14%	32%	24%	25	
* the correct answer of the Question						

Streptococcus Viridans was chosen by 60.2% of medical students and 40% of dental students as the most causative pathogen of Infective endocarditis ($p= 0.343$) (Table 4).

Table 4 : The Most Common Causative Pathogen of Infective Endocarditis

College	Staphylococcus Aureous	Streptococcus Viridans *	Candida Albicans	Actinobacillus actinomycetemcomitans	N	P
Medicine	9.7%	60.2%	17.2%	12.9%	93	0.343
Dentistry	16 %	40%	24%	20%	25	
* the correct answer of the Question						

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Only 33.3% medical students and 40% of dental students agreed that the bacteremia resulted from invasive dental procedures usually lasts for about 10 to 15 minutes and the difference between the knowledge of both groups was not significant p= 0.502 (Table 5).

Table 5 : The Bacteremia Resulted from Invasive Dental Procedures Usually Lasts for about

College	10 to 15 minutes*	1 to 2 hours	3 to 4 hours	5 to 6 hours	N	P
Medicine	33.3%	24.7%	25.8%	16.2%	93	0.502
Dentistry	44%	28%	12%	16 %	25	
* the correct answer of the Question						

Concerning dental procedures in which antibiotic prophylaxis is not indicated the percentage of correct answers 43% among the medical students and 68% among the dental students. The difference between the knowledge of the two groups was statistically significant p= 0.002 (Table 6).

Table 6 : According to American Heart Association, in Which of The Following Dental Procedures Antibiotic Prophylaxis is not Indicated

College	Dental extraction	Initial placement of orthodontic bands	Scaling and root planning	Restoration of occlusal class 1 cavity on the first upper molar*	N	P
Medicine	0%	21.5%	35.5%	43 %	93	0.002
Dentistry	0%	32.0%	0%	68.0%	25	
* the correct answer of the Question						

51.6% , 52% of medical and dental student respectively, truly answered that AHA lists electric toothbrushes as recommended dental aids for patients who are susceptible to infective endocarditis, p= 0.576 (Table 7).

Table 7 : AHA Lists Electric Toothbrushes as Recommended Dental Aids for Patients who are Susceptible to Infective Endocarditis

College	True*	False	N	P
Medicine	51.6%	48.4%	93	0.576
Dentistry	52.0%	48.0%	25	
* the correct answer of the Question				

Amoxicillin was chosen by 57 % of medical students and 68% of dental students as the first-line antibiotic for prevention of infective endocarditis in dental practice according to AHA guideline. The difference between the knowledge of the medical and dental students was statistically significant p= 0.019 (Table 8).

Table 8 : According to AHA Guideline, the First-Line Antibiotic for Prevention of Infective Endocarditis in Dental Practice is

College	Clindamycin	Amoxicillin*	Azithromycin	Cephalexin	N	P
Medicine	20.4%	57%	0%	22.6%	93	0.019
Dentistry	8%	68%	8%	16%	25	
* the correct answer of the Question						

Concerning the antibiotics that is no longer recommended by the AHA for prevention of infective endocarditis, 43% medical students and 32% of dental students correctly chose Erythromycin. The difference was not statistically significant p= 0.575 (Table 9).

Table 9 : Which of the Following Antibiotics is No Longer Recommended by the AHA for Prevention of Infective Endocarditis

College	Erythromycin*	Parenteral ampicillin	Parenteral cefazolin (Ancef)	Cephalexin (Keflex)	N	P
Medicine	43 %	30.1%	18.3%	8.6%	93	0.575
Dentistry	32%	32%	16%	20%	25	
* the correct answer of the Question						

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50.5% of medical students and 34.0% of dental students correctly selected Cephalexin, 2 g PO, 1 hour before treatment that is the regimens recommended by AHA for antibiotic prophylaxis in susceptible patients among the other options. The difference between the knowledge of the two groups was statistically significant p= 0.036 (Table 10).

Table 10 : Which of the Following Regimens is Recommended by AHA for Antibiotic Prophylaxis in Susceptible Patients

College	Azithromycin, 1 g PO, 1 hour before treatment	Clarithromycin, 500 mg PO, 2 hours before treatment	Cephalexin, 2 g PO, 1 hour before treatment*	Penicillin V, 3 g PO, 1 hour before treatment	N	P
Medicine	8.6%	24.7%	50.5%	16.1%	93	0.036
Dentistry	24.0%	14.0%	34.0%	28.0%	25	
* the correct answer of the Question						

600 mg of clindamycin in the most recent set of recommendation for prevention of infective endocarditis was correctly chosen by 44.1% of medical students and 48.0% of dental students, p= 0.898 (Table 11).

Table 11 : What is the Clindamycin dose in the most Recent Set of Recommendation for Prevention of Infective Endocarditis

College	150 mg	300 mg	600 mg	1200 mg	N	P
Medicine	16.1%	18.3%	44.1%	21.5%	93	0.898
Dentistry	20%	16 %	48 %	16%	25	
* the correct answer of the Question						

45.2% of medical students and 48.0% of dental students were able to recognize the correct dose of amoxicillin for prevention of IE which is 2 g of amoxicillin PO 1 hour before the appointment. The difference between the knowledge of the medical and dental students was statistically significant p=0.015 (Table 12).

Table 12 : The Recommended Regimen for Antibiotic Prophylaxis using Amoxicillin is

College	1 g of amoxicillin PO 2 hours before the appointment	2 g of amoxicillin PO 1 hour before the appointment*	3 g of amoxicillin PO 1 hour before the appointment	4 g of amoxicillin PO 2 hour before the appointment	N	P
Medicine	38.7%	45.2%	10.8%	5.3%	93	0.015
Dentistry	16.0%	48.0%	12.0%	24.0%	25	
* the correct answer of the Question						

Only 38.6% of medical students and 32.0% of dental students were able to recognize that the second dose of amoxicillin is no longer recommended for second (follow-up) based on the latest AHA guideline. p= 0.047 (Table 13).

Table 13: The Second (Follow-Up) dose of Amoxicillin According to the Latest AHA Guideline is

College	500 mg of amoxicillin PO 6 hours after the initial dose	1 g of amoxicillin PO 8 hours after the initial dose	1.5 g of amoxicillin PO 6 hours after the initial dose	The second dose is no longer recommended*	N	P
Medicine	15.1%	19.4%	26.9%	38.6%	93	0.047
Dentistry	36.0%	24.0%	8.0%	32.0%	25	
* the correct answer of the Question						

If the patient has forgotten to take his/her premedication , the effective prophylaxis is possible if the patient is medicated anytime up to 2 hours from the time of induced bacteremia was the correct answer that 45.2% of medical students and 24.0% of dental students were able to recognize , p= 0.083 (Table 14).

Table 14 : Your Patient has Forgotten to take his/her Premedication. in Such a Case, Effective Prophylaxis is Possible if the Patient is Medicated Anytime up to ……from the Time of Induced Bacteremia

College	1 hour	2 hours*	4 hours	There is no prophylactic benefit	N	P
Medicine	12.9%	45.2%	19.4%	22.6%	93	0.083
Dentistry	32.0%	24.0%	24.0%	20.0%	25	
* the correct answer of the Question						

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IV. Discussion

IE is a severe, life-threatening disease of the heart with poor prognosis.It is difficult to treat and has a high mortality rate. Bacteremia-inducing dental procedures are considered to be one of the major factors[12][13]. An understanding of the various preventative and prophylactic measures is very important in this disease [14].

Some cases of IE occur after invasive procedures such as dental extraction that are associated with bacteremia. On the other hand, underlying cardiac conditions such as valvular abnormalities that render the patient susceptibility to IE are common. Considering these facts, AHA has started publishing recommendations for antibiotic prophylaxis and prevention of IE since 1955. This guideline is recently revised and updated and has been accepted as the standard of care in many countries around the world (1).

In the present study, we assessed awareness and knowledge of graduating medical &dental students at Qassim university, KSA, regarding the latest recommendations for prevention of IE published by AHA in 1997.

The mean marks of medical students in all three sets of questions were higher than that of dental students and the differences were not statistically significant. These findings are in disagreement with the results that have been reported by M. R. Zarei1, et al (10).

No significant difference in success rates or mean marks found according to sex in the present study.These findings are in agreement with the results that have been reported by M. R. Zarei1, et al (10).

Most dental procedures that cause tissue injury and bleeding which need antibiotic prophylaxis are tooth extraction ,Scaling and root planning and initial placement of orthodontic bands , both of which (1).

Dental procedures that do not need antibiotic prophylaxis are dental radiographs, prosthetic impression and routine anesthetic injections through noninfected tissue (1). The most critical thing in the present study that some of dental and medical students did not know that initial placement of orthodontic bands requiring preventive antibiotic in susceptible patients.

In this study, 70% of the participants selected amoxicillin as the antibiotic of choice, 54 % selected a single 2-g dose 1 hour before treatment and only 44 (37%) knew that the second (follow-up) dose was no longer recommended by the AHA. This study also showed that only 48 (40.7%) of the medical and dental students knew that erythromycin had been eliminated from the latest guideline for antibiotic prophylaxis.

Nelson and Van Blaricum in a study on 1131 dentists and physicians in the United States found out that only 39.2% of them adhered to the latest AHA guideline when prescribing antibiotic for IE prophylaxis (15). Nelson and Van Blaricum also demonstrated that physicians might not be as familiar with the latest AHA recommendations as dentists (15). In a study amongst clinicians in a teaching hospital, Solomon and colleagues showed that 62% of the participants had an acceptable level of knowledge about antibiotic prophylaxis and prevention of IE (6).

In another survey on the method of antibiotic prophylaxis against IE by dentists, Bennis and colleagues found out that only 21% of the dentists used the recommended dose of amoxicillin (16).

There is no doubt that lack of knowledge concerning AHA guidelines would lead to noncompliance. Considering the implication of invasive dental procedures in the development of IE, the severity of this disease, and the ease and efficiency of AHA recommendations, all dental and medical students should be qualified in prevention of IE (11). IE should be presented to the students using various methods of teaching in order to improve learning.

In summary, this study showed that the knowledge concerning prevention of IE among the dental and medical students was moderate and necessity of more education in this field.Dental student after graduation will provide dental care that could lead to development of IE in susceptible patients. Medical student after graduation will deal with IE susceptible patients and may receive medical consultation from the dentists.

V. Conclusions

The study highlighted the lack of knowledge regarding prevention of infective endocarditis among the mediacal and the dental students and the need of improvement of their knowledge and compliance with AHA guidelines for prevention of infective endocarditis.

VI. Acknowledgement

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