

Evaluation of the Knowledge of General Dental Practitioners about Prophylactic Prescription of Antibiotics for Bacterial Endocarditis in Hamadan in 2011–2012

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ABSTRACT

Statement of the problem: Infective endocarditis is a rare disease of the heart valves and endocardium, which develops after invasive dental procedures. Despite a large number of reports, little is known about awareness of this condition.

Purpose: The aim of this study was to determine the level of the knowledge of general dental practitioners (GDPs) in Hamadan about prophylactic prescription of antibiotics to prevent infective endocarditis.

Materials and methods: This cross-sectional descriptive analytical study was carried out in Hamadan in 2011. Ninety GDPs participated in this study and filled out a questionnaire. One-way ANOVA and chi-squared test were used for statistical analysis of data.

Results: The knowledge levels of GDPs about cardiac diseases, dental procedures requiring prophylaxis and endocarditis prophylaxis regimens were 62.4%, 64.9% and 42.1%, respectively. The overall knowledge in all the three parts was 56.1%. The relationship between level of GDPs' knowledge and gender was not statistically significant ($P=0.07$). The knowledge level of the 25–30 age group was higher than that of other groups and the difference was statistically significant ($P=0.04$). The 1–5 job experience group had the highest level of knowledge. Regarding prescription of prophylactic antibiotics for patients with prosthetic cardiac valves, 93.65% of the answers were correct. The most common procedures in which prophylactic antibiotics were deemed necessary were periodontal surgery (94.95%), tooth extraction (93.5%) and scaling and root planing (93.15%). 77.1% of the dentists had chosen *amoxicillin* as the first choice for prophylaxis.

Conclusions: Results of this study showed that the level of knowledge of GDPs about prophylaxis for endocarditis was satisfactory.

Key words: Antibiotic prophylaxis, Infective endocarditis, General dental practitioners.

INTRODUCTION

Infective endocarditis is the microbial infection of the endothelial surfaces of the

heart or heart valves, which usually occurs adjacent to congenital or acquired defects of the heart and is manifested as a visible vegetative lesion, resulting in injuries to or destruction of cardiac valves.^(1–4) Bacteria are the etiologic agents for microbial

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endocarditis in most cases; however, other microorganisms and fungi, too, might be involved. Therefore, the term “infective endocarditis’ is used for this condition, indicating that the resultant infection might have a polymicrobial origin.⁽⁵⁾

Streptococcus viridians (α -hemolytic *Streptococcus*) is a member of the normal flora of the oral cavity and gastrointestinal tract. It has also been reported to be the most common etiologic agent of endocarditis of normal cardiac valves subsequent to therapeutic procedures.⁽⁵⁾ The condition was fatal in 100% of cases before the discovery of antibiotics; however, at present the mortality rate is 10–80% due to advances in medical sciences and surgical interventions.⁽¹⁾

Some researchers have reported that the oral cavity is the portal of entry in patients with bacterial endocarditis in 13.7–20% of cases.⁽⁶⁾ The importance of dental procedures and oral infections in the induction of bacterial endocarditis has made the condition an important issue in the laws and regulations in many countries, necessitating that dental practitioners be adequately aware in this respect.⁽⁷⁾

The prophylactic regimen of the American Heart Association (AHA) has been accepted by all the medical and heart associations all over the world.⁽⁸⁾ AHA introduced a prophylactic regimen to the medical community, which specifies that all the dental procedures involving gingival tissues, periapical areas and perforation of

the oral cavity mucous membranes require prescription of antibiotics in susceptible patients. These patients include individuals with prosthetic heart valves, a history of endocarditis, some congenital cardiac defects, and finally recipients of heart transplants.⁽⁵⁾

Antibiotics are used in dentistry in the treatment of infections and prevention of endocarditis. However, indiscriminate prescription of antibiotics in procedures which do not require antibiotics results in the overgrowth of microbial agents (drug resistance), extra costs and drug side effects.^(1,7)

Considering the fact that infective endocarditis still has some mortality despite advances in the medical science and some studies have reported a relationship between infective endocarditis and bacteremia as a result of dental and oral hygiene procedures, the present study was undertaken to determine the knowledge of dental practitioners in Hamadan, Iran, in relation to the prescription of prophylactic antibiotics so that the condition can be prevented by appropriate plans in future.

MATERIALS AND METHODS

This descriptive cross-sectional study was carried out in 2011 in Hamadan, Iran. The sample sizes are all the general dental practitioners working in private dental offices in Hamadan and by enquiry from the Medical Council of Hamadan. A questionnaire was used for collection of data. The questionnaire included

demographic data and 35 questions in relation to knowledge level of the respondents about cardiac conditions, dental procedures and the latest version of antibiotic prophylactic regimen. A group of 10 dental specialists confirmed the validity of the questionnaire. Ten general dental practitioners filled out the questionnaire in order to evaluate its reliability. After the questionnaires were collected a statistician determined the questionnaire reliability by Cronbach's Alpha coefficient(0.89). Then the questionnaire was handed in personally to 105 general dental practitioners in Hamadan. All the respondents completed the questionnaires with consent anonymously and they were reassured the data would be kept confidential. After the questionnaires were collected, the questionnaires with more than 30% of the questions unanswered were excluded from the study; a total of 90 questionnaires were finally evaluated. Each correct reply received one point and wrong replies and no replies received no points. There were a total of 35 questions on the questionnaire and knowledge was evaluated on the basis of the ratio of correct replies to 35 questions. The total score of each questionnaire was expressed in percentage, using the following classification:

Very good: more than 80

Good: 60–79.9

Satisfactory: 50–59.9

Unacceptable: less than 50

Data was analyzed with descriptive (frequency and percentage) and analytical statistics (ANOVA and chi-squared test) using SPSS 15 at a significance level of $p < 0.05$.

RESULTS

In the present study questionnaires were submitted to 105 general dental practitioners in Hamadan. Finally, a total of 90 questionnaires, which included the necessary data and replies, were evaluated and analyzed. Males and females comprised 55.1% and 44.9% of the respondents, respectively. A total of 10% of dentists were in the 25–30 age bracket, with 31%, 38% and 21% in the 30–35, 35–40 and over-40 age brackets, respectively. In relation to job experience, 4.4% had job experiences of 1–5 years, with 31%, 47% and 17.6% having job experiences of 5–10, 10–15 and over 15 years, respectively. A total of 84 respondents had replied the question related to continuous education programs on antibiotic prescription, of which 53.6% had participated in such programs.

Knowledge levels of female and male dental practitioners about cardiac conditions requiring prescription of prophylactic antibiotics were 63.6% and 61.6%, respectively, with no statistically significant differences ($p = 0.075$).

The highest knowledge level of the respondents in relation to cardiac conditions requiring antibiotic regimens was related to the 25–30 age bracket (65.3%) and

statistically significant differences were observed only between the 25–30 and over-40 age brackets ($p=0.04$).

The highest knowledge level of the respondents about cardiac conditions requiring prophylactic prescription of antibiotics, in GDPs with different job experience, was observed in the 1–5-year job experience group (69.1%) and statistically significant differences were observed only between the over-15-year group and other groups ($p=0.03$).

The knowledge levels of male and female dental practitioners in relation to the dental procedures which require prophylactic prescription of antibiotics were 63.1% and 66.5%, respectively, with no statistically significant differences ($p=0.07$).

In relation to the knowledge of GDPs in Hamadan about dental procedures which require prophylactic prescription of antibiotics separately in different age groups, the highest knowledge level was seen in the 25–30 age group (75.1%); statistically significant differences were observed between the 25–30 age group and other groups. ($p=0.04$). In addition, there were significant differences between the 30–35 and the over-40 age groups ($p=0.04$). The highest level of knowledge about therapeutic procedures requiring prophylactic prescription of antibiotics separately in different job experience groups was 72% in the 1–5-year job experience group, with significant

differences between the 1–5-year and over-15-year job experience groups ($p=0.003$).

The knowledge levels of male and female GDPs about the latest antibiotic prophylactic regimen were 43.4% and 41.2%, respectively, with no statistically significant differences ($p=0.097$).

The highest knowledge level of the new prophylactic antibiotic regimen was observed in the 25–30 age group (65.4%), which was statistically significant ($p=0.002$). The 30–35 age group had higher knowledge level compared to the 35–40 and over-40 age groups, with significant differences ($p=0.03$ and $p=0.04$).

The 1–5-year job experience group exhibited the highest knowledge level of the latest antibiotic prophylactic regimen (58.77%), which was statistically significant ($p=0.04$).

The overall knowledge of GDPs in Hamadan about the prophylactic antibiotic regimen for infective endocarditis was 56.1% based on the replies provided in the questionnaire, which was acceptable based on the criteria of the present study. The average levels of knowledge in male and female GDPs in Hamadan were 54.8% (satisfactory) and 58.1% (satisfactory), respectively, with no statistically significant differences between the two groups ($p=0.07$).

The knowledge level of the 25–30 age group (68.6%) was higher than that of other groups and the difference was statistically significant ($P=0.04$). Spearman's

correlation coefficient and P-value were -0.67 and 0.024, so the relationship between age and the overall knowledge was statistically significant. Since Spearman's correlation coefficient was negative, the knowledge level decreased significantly with aging.

Evaluation of the relationship between job experience and the overall knowledge about prescription of prophylactic antibiotics to prevent bacterial endocarditis showed that the 1–5 job experience group had the highest level of knowledge (56.4%). Spearman's correlation coefficients were -0.079 and 0.01, so the relationship between job experience and the overall knowledge

was statistically significant. Since Spearman's correlation coefficient was negative, the knowledge level decreased significantly with an increase in job experience.

Table 1 shows the responses of GDPs and Table 2 shows mean and standard deviations for knowledge in the level of independent variables.

Table1: Demographic Characteristics of participants and descriptive of overall knowledge in each of variable levels

variable	level	N(%)	Mean(SD) of knowledge	p
sex	male	49(55.1)	54.8 (11.6)	0.07
	female	41(44.9)	58.1 (7.7)	
Age(year)	25-30	9(10)	68.6 (11.2)	0.04
	30-35	28(31)	54.9(10.7)	
	35-40	34(38)	53.8(12.3)	
	>40	19(21)	48.5(7.1)	
Work history (years)	1-5	4(4.4)	65.4(11.6)	0.002
	5-10	28(31)	57.4(9.7)	
	10-15	42(47)	57.3(9.7)	
	>15	16(17.6)	47.9(10.7)	
Participated in courses				0.26
	Yes	48(53.6)	56.5(2.6)	
	No	42(46.4)	55.6(10.3)	

Table 2. Responses of GDPs in Hamadan to questions on cardiac conditions and dental procedures requiring prophylactic prescription of antibiotics before the procedure

Questions	Responses	Correct response	Incorrect response
For which of the following cardiac conditions do you prescribe prophylactic antibiotics?			
Prosthetic cardiac valves +		93.65%	6.35%
A history of bacterial endocarditis +		95.22%	0.07%
Rheumatic heart disease with valvular dysfunction -		53.1%	46.9%
Coronary bypass -		52%	48%
Mitral value prolapse with regurgitation -		31.65%	68.35%
Mitral value prolapse without regurgitation -		60.35%	39.65%
Patients with a pacemaker -		48.6%	51.4%
Tetralogy of Fallot +		73.15%	26.85%

In which of the following dental procedures with a systemic background do you prescribe antibiotics?

A patients who is a candidate for tooth extraction +	94.95%	6.5%
A patients who is a candidate for gingival surgery +	94.95%	5.05%
Endodontic treatment +	33.75%	66.25%
A patients who is a candidate for scaling and polishing +	93.15%	6.85%
Placement of a subgingival cord +	25.7%	74.3%
Patients with a periapical abscess or lesion +	70%	30%
Placement and removal of orthodontic brackets +	71.95%	28.05%
Placement and removal of orthodontic bands -	82%	18%
Removal of sutures +	51.65%	48.35%
Replantation of avulsed teeth +	82%	18%
Gingival probing +	48.6%	51.4%
Injection of an anesthetic agent (block, infiltration) -	48.3%	51.7%
Intra-ligamental injection of an anesthetic agent +	64.7%	36.3%
Taking an impression for a prosthesis -	93.7%	6.3%

+: procedures requiring prophylaxis
-: procedures not requiring prophylaxis

Table 3. Responses of GDPs in Hamadan to questions on the use of the latest antibiotic prophylactic regimen

	Questions	Responses	Percentage of response
	Which of the following is correct for the standard prophylactic regimen for adults?		
a	<i>Amoxicillin</i> 2 g one hour before the procedure and 1.5 g six hours after the procedure		11.1%
b	<i>Amoxicillin</i> 2 g one hour before the procedure		76.6%
c	<i>Amoxicillin</i> 3 g one hour before the procedure and 1 g six hours after the procedure		12.3%
d	<i>Erythromycin</i> 3 g one hour before the procedure and 1 g six hours after the procedure		0
	In cases of allergy to penicillin what is the first oral antibiotic prophylactic choice in adults?		
a	<i>Erythromycin</i> 500 mg one hour before the procedure		39%
b	<i>Cephalexin</i> 2 g one hour before the procedure		23.8%
c	<i>Clindamycin</i> 600 mg one hour before the procedure		30.1%
d	<i>Ampicillin</i> 2 g one hour before the procedure and 1 g six hours after the procedure		71.1%
	Which choice is correct for the intravenous prophylactic regimen for endocarditis in adults?		
a	<i>Ampicillin</i> 2 g half an hour before the procedure and half of the dose 6 hours after the procedure		23.8%
b	<i>Ampicillin</i> 2 g half an hour before the procedure		30.1%
c	<i>Cephazolin</i> 2 g half an hour before the procedure and half of the dose 6 hours after the procedure		39%
d	<i>Cephtriaxon</i> 2 g of half an hour before the procedure		71.1%

“b” is the correct choice.

Discussion

The overall knowledge of general dental practitioners in Hamadan, Iran, about the three parts of the questionnaire was approximately 56.1%, which was considered satisfactory based on the criteria set for the present study. The knowledge level determined by the present study was higher than those reported in similar studies

by Hashemipour et al(9) (38.7%), Carmona et al(7) (30%), and Bennis et al,(10) which might be attributed to better educational courses on prescription of prophylactic antibiotics in Hamadan or might be due to different questions in their questionnaires.

In the present study, the knowledge levels of GDPs about prescription of prophylactic antibiotics were 54.8% and 58.1% in males

and females, respectively, indicating that gender had no effect on the general knowledge of dental practitioners ($P>0.05$), consistent with the results of studies by Chitsazi et al,⁽¹¹⁾ and Palmer et al,^(12,13) but contrary to the results of a study by Hashemipour et al, in which females had a significantly higher overall knowledge level. This difference may be due to the different populations studied.

Based on the results of the present study, there was a significant relationship between age and general knowledge level ($p<0.05$), i.e. there was a decrease in knowledge level with advancing age, consistent with the results of studies by Pealing et al⁽¹²⁾ and Hashemipour et al.⁽⁹⁾ This decrease in knowledge level might be attributed to the fact that the data on the subject are forgotten with time or to a lack of interest or adequate time to study and review the necessary information or the inability to update what has been learned before.

There was a significant relationship between job experience and the overall knowledge of GDPs ($p<0.05$), i.e. there was a decrease in knowledge about prophylactic measures for endocarditis with an increase in job experience, which is consistent with the results of studies by Lauber et al⁽¹⁴⁾ and Matallebnejad et al,⁽¹⁵⁾ who reported that physicians and dentists with job experiences of more than 20 years were significantly less aware of prophylactic measures for endocarditis compared to their colleagues with less job experience.

Similar to the effect of age, this finding might be attributed to lack of studying due to lack of interest in learning and a decrease in time available to think about and search for new knowledge, including bacterial endocarditis and lack of knowledge about the role of dentists in this condition.

In the present study, there were no significant differences between the GDPs who had participated in continuous education programs and those who had not; however, in a study by Plamer et al⁽¹⁵⁾ there was a significant difference between the knowledge levels of dentists participating in continuous education programs and those not participating in such programs. This may be due to differences in level of continuous education programs and in the interest of participants.

In the present study level of knowledge about cardiac conditions requiring endocarditis prophylactic measures was 62.4%, which was considered good based on the criteria of the present study. In the present study, cardiac conditions requiring prophylactic measures based on the respondents' idea were prosthetic cardiac valves (93.65%) and a history of endocarditis (92.95%), consistent with the results of a study by Hashemipour et al.⁽⁹⁾

The mean knowledge level of GDPs about cardiac conditions requiring prophylactic antibiotics was higher in females, without any significant differences between males and females, consistent with the results of a study by Chitsazi et al.⁽¹¹⁾

The highest knowledge level about cardiac conditions needing prophylactic antibiotics was related to the 1–5-year job experience group.

Evaluation of the relationship between knowledge levels of GDPs participating in continuous education programs on prophylactic prescription of antibiotics showed that the highest level of knowledge was related to those participating in these programs and a search in different sources and databases failed to bring up any similar studies.

In the present study, the overall knowledge about dental procedures requiring prophylactic antibiotics was 64.9%, which was considered good based on the criteria of the present study and was less than that (76.2%) in a study by Chitsazi et al.⁽¹¹⁾

In the present study, based on the data provided by the respondents on the questionnaires in Hamadan, the most common dental procedures which were considered not requiring prescription of prophylactic antibiotics included endodontic treatment (66.25%), placement of subgingival cords (74.3%), removal of orthodontic brackets (71.95%) and probing of the gingiva (51.4%), which is not acceptable based on the protocol of antibiotic prophylactic measures; the knowledge levels determined in the present study were unacceptable compared to those of a study by Hashemipour et al: 33.75% vs. 55.3 for endodontic treatment, 27.7 vs. 68.8% for subgingival cords, 28.15% vs.

47.8 for placement of orthodontic brackets, in the present study and the study by Hashemipour, respectively. The lower level of knowledge in the present study might be attributed to a lack of knowledge, in the present study, about the protocol because in the protocol the majority of dental procedures require prophylactic prescription of antibiotics.⁽⁹⁾

The mean of the knowledge levels of female GDPs about dental procedures requiring prophylactic use of antibiotics was higher, but the difference was not statistically significant, consistent with the results of a study by Chitsazi et al.⁽¹¹⁾

Evaluation of the age groups separately in relation to the dental procedure requiring prophylactic use of antibiotics showed that the highest knowledge level (75.1) was related to the 25–30 age group.

Evaluation of job experience groups separately in relation to the knowledge level of dental procedures requiring antibiotic prophylaxis showed a significant difference between the 1–5-year job experience group (72%) and the over-15-year group ($p < 0.05$). The results of a study by Chitsazi et al⁽¹¹⁾ showed that knowledge levels decreased with an increase in job experience.

Evaluation of the knowledge of GDPs separately in relation to participation in continuous education programs on the prophylactic use of antibiotics showed a knowledge level of 66.3%, with no

significant differences from those not participating in such programs.

Extensive search in various databases failed to find any similar studies on the three subjects mentioned above.

In the present study the level of knowledge about the latest prophylactic regimen for the prevention of endocarditis was unacceptable; however, the level determined in the present study was higher than that reported by Chitsazi et al (32.2%),⁽¹¹⁾ which might be attributed to better educational programs for dental practitioners in Hamadan or participation in continuous education programs on prophylactic use of antibiotics in dentistry.

In the present study, approximately 77.1% of the respondents had chosen *Amoxicillin* as the first choice for prophylaxis, which is consistent with the results of a study by Hashemipour et al⁽⁹⁾ with 65.8%. The reason might be attributed to a higher level of familiarity of dental practitioners with this antibiotic and its use in dentistry.

In addition, 23.8% of the respondents had selected *Cephalexin* as the first choice in case of allergies to the penicillin group, which is considered a very low level of knowledge considering the fact that in the new protocol⁽¹⁶⁾ *Cephalexin* has been introduced as the main alternative for *Amoxicillin*. In comparison with other studies, including a study by Hashemipour et al, in which 67.8% of the respondents had selected *Clindamycin* (the first choice in the protocol referred to), this knowledge

level is lower, i.e. the participants in that study had a higher level of knowledge.

In addition, the respondents in the present study had the lowest knowledge level about intravenous antibiotic regimens; the knowledge levels of intravenous prophylactic regimen in cases of allergies to penicillin in children and adults were 24.6% and 28.3%, respectively. This low level of knowledge might be attributed to less frequent use of intravenous forms of antibiotics in dental patients and low knowledge levels of dentists about the doses and frequencies of the use of such antibiotics. It was not possible to compare the results of the present study in this respect with those of other studies due to a scarcity of studies in this respect.

There were no significant differences in the knowledge levels of male and female GDPs about the latest antibiotic prophylactic regimen, consistent with the results of a study by Chitsazi et al.⁽¹¹⁾

Evaluation of the age groups separately in relation to the level of knowledge about the latest prophylactic regimen showed a significant difference between the 25–30 age group and other age groups, consistent with the results of a study by Chitsazi et al.⁽¹¹⁾

Evaluation of job experience groups separately in relation to the use of the latest prophylactic regimen showed a significant difference in knowledge levels of the 1–5-year job experience group and the other groups, consistent with the results of

studies by Chitsazi et al.⁽¹¹⁾ and Motallebnezhad et al.⁽¹⁵⁾

Evaluation of knowledge levels of GDPs separately in relation to participation in continuous education programs on prophylactic prescription of antibiotics and its relationship with the use of the latest antibiotic regimen did not reveal any significant differences. It was not possible to carry out comparisons in these two cases, either, due to a lack of any references and similar articles.

Infective endocarditis is a rare condition but it should be emphasized that afflicted individuals have a very poor prognosis (17). Studies on the efficacy of endocarditis prophylactic regimen have shown that even if all the individuals susceptible to infective endocarditis receive a prophylactic antibiotic regimen, only a very small percentage of these individuals (5.3%) will be protected against the condition.⁽¹⁸⁾ Therefore, the efficacy of the prophylactic antibiotics should be weighed up against the side effects, growth and proliferation of resistant microorganism and its high costs. However, in general, despite all the contradictions and controversies over the use of prophylactic antibiotics, use of such antibiotic regimens is inevitable in patients susceptible to infective endocarditis.⁽¹⁶⁾

Certain dental procedures or oral infections are considered important etiologic agents for bacterial endocarditis; however, the role of dental practitioners should not be ignored in this respect. On the other hand,

since the American Heart Association, with collaboration from the American Dental Association, has made some modifications to the guidelines of prophylactic prescription of antibiotics before dental procedures,⁽¹⁶⁾ studies such as the present study seem to be very important, although it has been carried out in a small community compared to the whole country. In addition, according to the results of the present study and some other studies, there is a decrease in knowledge levels of dentists about prophylactic regimens for this condition with age and with an increase in job experience. On the other hand, efforts to promote knowledge of dentists about the subject will decrease the toll taken on national resources and general health of the community. Therefore, it is suggested that such studies be carried out in order to identify factors affecting the results and present guidelines to solve the problems encountered and to update the knowledge of dentists so that they will be able to gain knowledge on the importance of prophylaxis for endocarditis in dental patients susceptible to such conditions. Therefore, it will be possible to prevent the development of this rare but dangerous condition which has a poor prognosis.

CONCLUSION

According to the results of the present study, the overall knowledge of GDPs in Hamadan about prophylactic measures for bacterial endocarditis was satisfactory; however, knowledge level decreased with

age and with an increase in job experience. The results showed that the knowledge level of GDPs in relation to medical aspects of endocarditis prophylaxis is lower than its dental aspects.

Therefore, various educational programs on prophylactic measures for endocarditis should be included in university curricula for university students; after graduation from the university continuous education programs, articles, and/or mass media coverage should be considered.

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