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Original Article / Özgün Makale

Do patients with mechanical heart valves have the appropriate knowledge regarding warfarin therapy and can they adhere to the correct dosage?

Mekanik kalp kapağı olan hastalar varfarin tedavisine ilişkin uygun bilgiye sahip mi ve doğru doza uyuyorlar mı?

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ABSTRACT

Background: This study aims to determine the knowledge level regarding warfarin therapy and adherence to therapy of patients with mechanical heart valve.

Methods: This descriptive study included 114 patients (56 males, 58 females; mean age 53.0±13.5 years; range 18 to 80 years) who received warfarin therapy for at least three months at the Department of Cardiovascular Surgery of Ege University Medical Faculty Hospital between 4 October 2012 and 30 May 2013. Patients who agreed to participate in the study were older than 18 years of age and literate. Data were collected by using sociodemographic profiles and a questionnaire form on knowledge of and adherence to warfarin therapy. A score of 1 (one) was given to patients' correct answers, and 0 (zero) was given to incorrect or "I don't know" answers for each item on the scale, and mean scores were obtained. Patients' adherence to warfarin was measured by four questions involving *(i)* regular use of the medication as prescribed by doctors, *(ii)* forgetting to take the medication, *(iii)* delaying for more than 24 hours, and *(iv)* frequency of overuse. The answers to these four questions were evaluated based on a 100 mm visual analog scale.

Results: Patients' mean score regarding anticoagulant therapy was 9.8±3.9 (lowest: 2, highest: 20) out of 22. Of the patients, 62.3% (n=71) stated that they used warfarin precisely as prescribed by doctors (100%).

Conclusion: It was determined that patients with mechanical heart valve and using warfarin had low level of knowledge regarding warfarin therapy and that they experienced problems in terms of their adherence to the medication.

Keywords: Adherence; anticoagulant; knowledge level; mechanical heart valve.

ÖZ

Amaç: Bu çalışmada mekanik kalp kapağı olan hastaların varfarin tedavisi hakkındaki bilgi düzeyleri ve tedaviye uyumları belirlendi.

Çalışma planı: Bu tanımlayıcı çalışmaya 4 Ekim 2012 - 30 Mayıs 2013 tarihleri arasında Ege Üniversitesi Tıp Fakültesi Hastanesi Kalp ve Damar Cerrahisi Anabilim Dalı Polikliniği'nde en az üç ay varfarin tedavisi alan 114 hasta (56 erkek, 58 kadın; ort. yaş 53.0±13.5 yıl; dağılım 18-80 yıl) dahil edildi. Çalışmaya katılmayı kabul eden katılımcılar 18 yaşın üzerinde ve okuryazardı. Veriler sosyo-demografik profiller ve varfarin tedavisi hakkında bilgi ve tedaviye uyuma yönelik bir soru formu kullanılarak toplandı. Ölçekteki her madde için hastaların verdiği doğru cevaplara 1 (bir), yanlışlara ya da "bilmiyorum" cevaplarına 0 (sıfır) puan verilerek ortalama puanlar elde edildi. Hastaların varfarin dozuna uyumları *(i)* ilacı hekimin önerdiği şekilde düzenli kullanma, *(ii)* ilacı almayı unutma, *(iii)* 24 saatten fazla geciktirme ve *(iv)* gerekenden fazla alma sıklığına ilişkin dört soru ile ölçüldü. Bu dört sorunun cevabı 100 mm'lik bir görsel analog ölçeği ile değerlendirildi.

Bulgular: Hastaların antikoagülan tedavi hakkında puan ortalaması 22 üzerinden 9.8±3.9 idi (en düşük: 2, en yüksek: 20). Hastaların %62.3'ü (n=71) varfarini tam olarak (%100) hekimin önerdiği şekilde kullandığını belirtti.

Sonuç: Mekanik kalp kapağı olan ve varfarin kullanan hastaların varfarin tedavisi hakkında bilgi düzeylerinin düşük olduğu ve ilaca karşı uyumlarında sorunlar deneyimledikleri belirlendi.

Anahtar sözcükler: Uyum; antikoagülan; bilgi düzeyi; mekanik kalp kapağı.

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Replacing a diseased heart valve with a mechanical prosthesis is a routine procedure with low perioperative morbidity and mortality rates.[1] However, the potential risk of thromboembolism postoperatively is still a major concern.[1] For this reason, patients are required to receive lifelong oral anticoagulant therapy,[1-4] with warfarin (Coumadin, Zentiva Sağlık Ürünleri Sanayi ve Tic. A.Ş. Levent, İstanbul) being the normal drug of choice.[5] Unfortunately, because of its narrow therapeutic range, warfarin causes various complications, the most serious of which is bleeding.[5-7] Despite its wide usage, most patients are not aware of warfarin's side effects, and they do not know that laboratory follow-up tests [e.g., international normalized ratio (INR) and prothrombin time (PT)], and warfarin-food interactions can inhibit the effectiveness of this medication.[5,7-10]

Nurses have a key role in a patient's adherence to treatment and the evaluation of its efficacy since they are in close contact with them 24 hours a day. Hence, a more effective nursing approach to individuals receiving warfarin therapy may improve the adherence to treatment and either avoid or minimize certain side effects.[5,11] The goal of this research was to determine the patients' knowledge level regarding warfarin therapy and assess their ability to adhere to the proposed treatment regimen.

PATIENTS AND METHODS

This descriptive study included 114 patients (56 males and 58 females; mean age 53.0±13.5 years; range 18 to 80 years) who received warfarin therapy at the Department of Cardiovascular Surgery of Ege University Medical Faculty Hospital for at least three months between October 4, 2012 and May 30, 2013. All of the patients who agreed to participate in the study were over the age of 18 and literate. No sampling method was used. All of the participants, except those who were pregnant, were included within the scope of the research. The total number of patients who underwent mechanical heart valve replacement at the same hospital in 2011 was 78.

For data collection, we used a questionnaire form developed by researchers in accordance with the related literature.[10,12,13] This included a total of 47 questions to determine the patients' sociodemographic data as well as their level of knowledge regarding warfarin and their ability to adhere to this drug treatment. To ensure the content validity of the questionnaire, seven experts in the field were consulted and asked to evaluate the items in terms of their appropriateness to Turkish society, linguistic clarity, and comprehensibility. For a proper consideration of the experts' views, a content validity index (CVI) was used, and each question was scored on a scale ranging from 1 ("not appropriate") to 4 ("very appropriate"). Any necessary changes were then made in accordance with the expert views, and the form was then updated. Next, a pre-application was conducted with 10 patients who had similar characteristics to the sample, and to test the clarity, comprehensibility, and functionality of the items, they were informed about the process beforehand. After this was completed, the questionnaire was further updated to obtain the finished product.

The form included 21 multiple-choice questions that measured the patients' knowledge with regard to warfarin therapy. Each question had four possible options, but only one of these was correct. To avoid random answers, an "I don't know" option was added to the others; thus, each question had five options. The average scores were calculated by assigning a score of 1 to the correct answers and a score of 0 to the incorrect or "I don't know" answers. The minimum score patients could receive was 0 while the maximum was 21. Then the total scores were evaluated and put into one of three categories: high (16-21 points), moderate (8-15 points), or low (0-7 points).

The patients' adherence to warfarin dosage was assessed via four questions which focused on regularly using the medication as prescribed by doctors, forgetting to take the medication, delaying to take it for more than 24 hours, and overusing the drug.

The data was collected via face-to-face interviews conducted by the researchers, and after the patients answered the questions, they were given the correct answers. The interviews lasted 30 minutes on average.

Before the research was conducted, the study was approved by the Scientific Ethics Committee of Ege University, Nursing Faculty and the institution where the research would be conducted. In addition, the patients were informed about the details of the study, and we obtained verbal consent from all of the volunteer participants for their participation.

Statistical analysis

The data was analyzed using the SPSS for Windows version 16.0 software program (SPSS Inc., Chicago, IL, USA). Descriptive statistics were presented as number, percentage, and mean, and compliance of the

quantitative variables with the normal distribution was assessed using the Shapiro-Wilk test. Additionally, an independent sample t-test was used for the normally distributed variables. For those that were not normally distributed, Spearman's correlation analysis and analysis of variance (ANOVA) were used, and for nominal and ordinal variables, a chi-square test was also performed. A *p* value of <0.05 was considered to be statistically significant.

RESULTS

The sociodemographic characteristics and the data related to the patients' warfarin usage are given in Tables 1 and 2, respectively.

The patients' average knowledge score regarding the anticoagulant therapy was 9.3±3.7 out of 21 points (lowest: 2; highest: 19). Based on the total scores, 29.8% of the patients (n=34) had low scores while 65.8% (n=75) had moderate and 4.4% (n=5) had high scores. The patients' answers to the questions related to anticoagulant therapy are given in Table 3.

No statistically significant difference was detected between the patients' complications and their knowledge of warfarin therapy [t=0.086, degrees of freedom (df)=112; p=0.932). We also found a negative correlation between the patients' age and their knowledge of warfarin. However, this did not reach statistical significance (r= -0.028 p=0.764).

Furthermore, we determined that there was no statistically significant difference between the patients' gender (t= -0.821; df=105.35; p=0.413), marital status (t= -1.318; df=112; p=0.190), place of residence (t=1.932; df=112; p=0.056), duration of warfarin usage (p=0.948), amount of education received regarding

Table 1. Patient distribution by their sociodemographic characteristics

Sociodemographic characteristics of the patients	n	%
Gender		
Female	58	50.9
Male	56	49.1
Educational status		
Primary school	74	69.9
High school	26	22.8
University	14	12.3
Marital status		
Married	95	83.3
Single	19	16.7
Profession		
Homemaker	43	37.7
Pensioner	42	36.8
Self-employed	13	11.4
Other	16	14.0
Social security		
Yes	110	96.5
No	4	3.5
Place of residence		
The province of İzmir	87	76.3
Outside the province of İzmir	27	23.7
Total	114	100

Table 2. Patient distribution by warfarin usage

Patients' warfarin usage	n	%
Duration of warfarin usage		
Less than 1 year	31	27.2
1-5 years	63	55.3
More than 5 years	20	17.5
Knowledge of warfarin dosage		
Yes	97	85.1
No	17	14.9
Takes warfarin at the same hour each day		
Yes	102	89.5
No	12	10.5
Uses medications other than warfarin		
Yes	109	95.6
No	5	4.4
Measures INR by themselves at home		
Yes	3	2.6
No	111	97.4
Knowledge of the last INR level		
Yes	103	90.4
No	11	9.6
Complications related to warfarin		
Yes	48	42.1
No	66	57.9
Types of complications related to warfarin (n=48, more than one answer)		
Nasal bleeding	25	21.9
Skin bruising	22	19.3
Gingival bleeding	17	14.9
Hematuria	6	5.3
Eye redness	6	5.3
Melena	3	2.6
Stomach bleeding	1	0.9
Vaginal bleeding	1	0.9
Received of warfarin education		
Yes	73	64
No	41	36
Source of education (n=73)		
Physician	46	63
Nurse	27	37
Total	114	100

INR: International normalized ratio.

Table 3. Patient distribution based on their answers to questions regarding their knowledge of anticoagulant therapy

Has knowledge of the fact that	Yes		No	
	n	%	n	%
Coumadin affects the liver and acts as a blood thinner	42	36.8	72	63.2
When a dose is missed, the next dose should be taken	73	64.0	41	36.0
Different doses of warfarin can be identified through their colors	96	84.2	18	15.8
The international normalized ratio test measures blood clotting	90	78.9	24	21.1
A high level of international normalized ratio indicates a high risk of bleeding while a low level of international normalized ratio indicates a high risk of blood clot formation	24	21.1	90	78.9
The international normalized ratio level should be checked at least once every four weeks	92	80.7	22	19.3
During consultation regarding international normalized ratio levels, physicians should be informed about missed doses	24	21.1	90	78.9
The most common side effect of warfarin therapy is skin bruising	61	53.5	53	46.5
Bleeding signs and symptoms should be watched regularly	37	32.5	77	67.5
Patients should immediately be admitted to the hospital if nasal bleeding does not stop	89	78.1	25	21.9
Patients have to consult with the surgeon in charge of the heart valve replacement when they start taking a new medication or when the warfarin dosage is changed	54	47.4	60	52.6
Vitamin K interacts with warfarin	72	63.8	42	36.2
Patients can consume the same amount of spinach each week during warfarin therapy	32	28.1	82	71.9
Coumadin interacts with calcium, herbal/dietary supplements and allergy medications	16	14.0	98	86.0
Broccoli interacts with warfarin	63	55.3	51	44.7
Dry beans, lentils, and kiwis interact with warfarin	71	62.3	43	37.7
Alcohol consumption during warfarin therapy will increase the level of international normalized ratio	20	17.5	94	82.5
Over-consumption of leafy green vegetables will reduce the effect of warfarin	40	35.1	74	64.9
Patients must use medications other than warfarin in the manner prescribed by their physicians	64	56.1	50	43.9
Patients must mention their use of warfarin before they make an appointment with a dentist	26	22.8	88	77.2
Patients should immediately inform their physicians in case of a new treatment involving the use of antibiotics	60	52.6	54	47.4

the use of warfarin (t= -0.146; df=112; p=0.884), and their knowledge of warfarin therapy. On the other hand, a statistically significant difference was found between the educational status of the patients and their knowledge level (p=0.001) as we determined that the university graduates (12.6±2.1) had a higher level of knowledge than the primary (8.6±3.7) and high school graduates (9.5±3.5).

Our findings also showed that 62.3% (n=71) of the patients stated that they used warfarin precisely as it was prescribed by doctors (100% adherence). Only one patient stated that they did not adhere to the doctors' advice (0 adherence) (Table 4).

In addition, 41.2% (n=47) said that they had not experienced delays in taking their warfarin within the previous month (100% adherence), whereas only

Table 4. Patient distribution based on their answers to questions related to their adherence to anticoagulant therapy

	n	%
Used warfarin precisely as prescribed by the physician		
Always	71	62.3
Generally	42	36.9
Never	1	0.8
Delayed warfarin intake within the previous month		
Never	47	41.2
Sometimes	59	51.8
Always	8	7.0
Forgot to take a warfarin dose within the previous month		
Never	71	62.3
Sometimes	42	36.9
Always	1	0.8
Took an overdose of warfarin within the previous month		
Never	80	70.2
Sometimes	34	29.8
Total	114	100

7.0% (n=8) stated that they had experienced frequent delays in taking their medication (0% adherence) (Table 4). Moreover, 62.3% (n=71) said that they had never forgotten to take their warfarin within the previous month (100% adherence) while just a single patient (0.8%) stated that they always forgot (0% adherence) (Table 4). Finally, 29.8% (n=34) of the patients answered that they had taken an overdose of warfarin within the previous month (0% adherence) (Table 4).

No statistically significant differences were found between the complications experienced by the participating patients and the education they received regarding warfarin usage (x^2=1.170; p=0.279), alcohol consumption (x^2=0.343; p=0.558) and their use of medications other than warfarin (x^2=3.803; p=0.051). However, we did identify a statistically significant difference between the complications experienced by the participating patients and the duration of warfarin usage (x^2=14.938; p=0.001). We also found that 12.9% of the patients who had used warfarin for less than a year (n=4), 52.4% of those who had used it for 1-5 years (n=33), and 55.0% of those who had used it for more than five years (n=11) had experienced complications, but no statistically significant differences were detected between these complications and the patients' knowledge levels related to their normal INR levels (x^2=0.330; p=0.566) and their last INR levels (x^2=0.773; p=0.379).

DISCUSSION

In this study, we determined that 14.9% of the participating patients (n=17) had no knowledge of how much warfarin they were receiving. In the study conducted by Mercan and Enç[14] with 114 individuals, 81.6% who did not know their warfarin dosage, so our results were much lower compared to theirs. In our study, we believe that this lack of knowledge was caused by the tendency of the patients to focus on the number of tablets rather than the number of milligrams they were taking, and the fact that 84.2% of our patients identified the different warfarin doses by their colors supports this belief. The tendency of individuals to identify their medication by tablet types without any knowledge of the correct dosage may mean they take the wrong medication at the wrong time, which could cause various complications. In the case study by Nural et al.,[15] they reported that a 53-year-old male patient lost his life after developing diffuse alveolar hemorrhage due to an overdose of warfarin. This was a direct result of taking two different doses of warfarin without knowing that they were the same medication. Therefore, doctors and nurses should make sure that their patients adequately understand their medication doses before they are discharged.

In the literature, it has been noted that home testing of INR or even self-management methods that allow for patient self-dosing and self-testing via standardized protocols are quite beneficial.[1,3] In contrast, our study indicated that only 2.6% of the patients performed self-testing of INR levels at home. Hence, further studies are needed to investigate the reasons for our low result.

Approximately half of the patients included in our study (42.1%) stated that they experienced complications related to warfarin usage. In the literature, bleeding is still the most common complications in mechanical heart valve patients.[1] Furthermore, interaction with other medications plays a major role in this condition. In support of this idea, we found that almost all of our patients (95.6%, n=109) regularly used medications other than warfarin.

In addition, the literature shows that mechanical heart valve patients and their families should be educated regarding the use of warfarin and how to manage the different dosage amounts.[3] Only 64% of the patients (n=73) in our study stated that they had received education related to warfarin usage, and

63% of these (n=46) said this education came from physicians while 37% said it came from nurses. In the study by Mercan and Enç[14] they found that 22.8% of their study participants had received educational information regarding the use of warfarin, with 76.9% receiving this information from physicians and 7.7% from nurses. The rate of patients in our study who were informed about warfarin usage by nurses was higher than in the Mercan and Enç study;[14] hence, we believe that they should realize that patient and discharge education are among their primary responsibilities.

This study identified some deficiencies related to the patients' knowledge about warfarin usage. It is essential that they have a high knowledge level regarding the need to adhere to their therapy in order to prevent complications. In the study conducted by Van Damme et al.[10] that focused on mechanical heart valve patients, the average knowledge score concerning warfarin therapy was 7 out of 10 points, whereas in our study, the patients' average score was 9.3±3.7 out of 21 points (lowest: 2; highest: 19). This lack of knowledge can negatively impact the patients' ability to adhere to their medication, which can lead to the development of complications; thus, our findings offer proof that mechanical valve heart patients need to be better education with regard to the use of warfarin.

A great majority of the patients in our study (78.9%, n=90) knew that the INR test measured blood clotting; however, they (78.9%, n=90) did not know that a high level of INR indicated a high risk of bleeding and that a low level of INR indicated a high risk of blood clot formation. This could also be interpreted as a lack of knowledge on the part of the patients with regard to warfarin usage. Furthermore, more than half of our patients (67.5%, n=77) did not know that they should regularly watch for signs and symbols of bleeding, which is the most common side effect associated with this type of therapy. In their study, Tang et al.[16] emphasized that those individuals who were warfarin users needed to be informed about the side effects of this medication, and Cheah and Marten[17] also pointed out this need as well.

Furthermore, warfarin-food interaction is an issue that requires significant consideration.[14,18] The literature points out that patients should be informed of possible changes in the INR in response to the use of herbal/dietary supplements or the chronic use of alcohol in large quantities.[19] Our findings indicated that a significant portion of the patients were not informed about which food groups would adversely interact with the warfarin. Hu et al.[20] determined that the major deficiency in their patients' knowledge was related to nutrition and vitamin K sources, and Mercan and Enç[14] found that none of their patients who were admitted to the emergency room because of complaints of bleeding due to warfarin usage had been informed about warfarin-food interaction. When our findings are compared with the literature, it must be acknowledged that mechanical heart valve patients are in need of education regarding warfarin-food interaction.

We anticipated that the patients who had received education related to warfarin would have higher scores on the questionnaire, but our results showed that more studies are needed to investigate the efficacy of the education given to these patients. Our other finding that conflicted with the literature[21] was that there was no meaningful difference between the patients' age and their experience with complications, but this might have been due to the small sample size in our study.

Low adherence to treatment may lead to negative clinical outcomes, hospitalization, increased health care costs, and mortality.[22] Since warfarin is a highly efficacious drug, a proper level of anticoagulation is difficult to maintain.[8] Therefore, a high level of adherence is crucial for the treatment to succeed. However, it is known that even patients who receive education regarding the importance of adherence to their warfarin therapy have difficulty in maintaining their medication regimens, and this poor adherence can have a significant effect on anticoagulation control.[8] As a result of our research, some problems were detected related to our patients' ability to adhere to their medication. The rate of patients who used warfarin precisely as it was prescribed by the doctors (i.e., those who fully adhered to the therapy) was only 62.3% (n=71). Van Damme et al.[10] also noted that only 72.2% of their patients had 100% adherence. We hypothesize that these low rates stem from the patients' insufficient knowledge of warfarin therapy.

For patients who are prescribed this drug, it is vitally important that they take the warfarin at the same time every day. More than half of our patients (58.8%) stated that they failed to follow a regular intake of their medication. In other words, there had been a delay in taking their warfarin within the previous month. However, only a few of our study participants (7%, n=8) expressed that they frequently delayed taking their medication. Another factor that affects a patient's ability to adhere to their drug

regimen is forgetting to take a dose, and a significant portion of our patients (37.7%) said that there were days within the previous month when they forgot to take their medication. Kimmel et al.[8] found that one-two missed doses a week caused a reduction in anticoagulation. Moreover, when INR levels fall a bit below the therapeutic range, it increases the risk of thromboembolism. Furthermore, this condition may lead to the need for higher dosage levels, new tests, a re-consultation with a physician, and incorrect dosage intake.

Although cases of overdosage are not very common, when this occurs, it is known to cause over-anticoagulation. In a previous study, 40% of the patients demonstrated poor adherence, which was clinically significant.[8] As an adherence factor, the rate of overdosage in that study within the previous month was low (28.2%), yet it is still an issue that should be emphasized in patient education since it may lead to bleeding complications.

Conclusion

In this study, we determined that the patients who underwent heart valve replacement and took warfarin had a low level of knowledge regarding warfarin therapy and that they experienced problems in terms of their adherence to their medication. However, because of the sample size used in our study, further studies should be undertaken on a larger number of patients to investigate these issues more thoroughly.

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