Evaluation of patients' knowledge on warfarin in outpatient anticoagulation clinics in a teaching hospital in Qatar

Imran F. Khudair, BScPharm, Yolande I. Hanssens, FESCP.

ABSTRACT

الأهداف: تقييم مدى ونوعية تعليم المرضى عن الوارفرين وتأثيره المحتمل على نسبة سيولة الدم (INR).

الطريقة: تم استخدام استبيان يحتوي على 20 سؤال في هذه الدراسة المستعرضة لمعرفة معلومات المرضى عن علاجهم بالوارفرين. كل المرضى الذين أكملوا ما لا يقل عن شهرين من العلاج بالوارفرين أو أكثر، والذين يحضرون عيادات مضادات التجلط الخارجية للأمراض الباطنية، أو أمراض القلب في مستشفى حمد العام – مؤسسة حمد الطبية – قطر خلال الفترة من أغسطس إلى نوفمبر 2008م.

النتائج: أكمل عدد 140 مريض الاستبيان. أفاد 116 (83%) مريض أنهم تلقوا تعليمات عن الوارفرين، و كان 61 مريض (44%) لديهم نسبة سيولة الدم مضبوطة INR. من بين 79مريض لديهم معرفة مقبولة بعلاج الوارفرين (أي علامة إجمالية لا تقل عن 75% في نتيجة الاستبيان)، بلغ 49 مريض (62%) نسبة سيولة علاجية مقارنة مع 12 مريض (20%) بمعرفة غير مرضية عن علاجهم الوارفرين (p<0.0001). كانت أدنى درجات المعرفة هي أثر نسيان الجرعة وكيفية التعامل معها (42%)، والتداخلات الدوائية مع الوارفرين (36%).

خاتمة: وضع برنامج متكامل ومتعدد التخصصات للتعليم قد يحسن معرفة المريض عن الوارفرين فضلاً عن تحسن امتثال المريض للإرشادات والنصائح الطبية. قد يؤدي هذا إلى سيطرة أفضل لنسبة سيولة الدم، وزيارات أقل للعيادات، وإنخفاض في تكاليف، ونفقات خدمة الرعاية الصحية. يجب إعطاء اهتمام خاص للمرضى كبار السن، والمرضى ذو المستوى التعليم المنخفض بالإضافة إلى حواجز اختلاف اللغة.

Objectives: To evaluate the extent and quality of the patient's education on warfarin and its possible impact on the international normalized ratio (INR).

Methods: This is a cross-sectional study using a 20-item, self administered questionnaire of knowledge, offered to patients who were taking warfarin for at least 2 months and attending the medical or cardiology anticoagulation clinics in Hamad General Hospital, Hamad Medical Corporation, State of Qatar between August 2008 to November 2008.

Results: A total of 140 patients completed the questionnaire, 116 patients (83%) reported that they received warfarin education and 61 patients (44%) had a controlled INR. Of the 79 patients with satisfactory knowledge (namely, overall score of at least 75%), 49 (62%) had a therapeutic INR compared with 12 (20%) having unsatisfactory knowledge (p<0.0001). The lowest scores were for participants' knowledge on the effects of a missing dose and its management (42%) and for warfarin drug interactions (36%).

Conclusion: An integrated and multidisciplinary education program may improve the patient's knowledge on warfarin as well as patient's compliance. This might lead to a better anticoagulation control, fewer clinic visits, and decrease in healthcare service load. Special attention should be addressed to geriatric patients and to those patients with low educational level and language barriers.

Saudi Med J 2010; Vol. 31 (6): 672-677

From the Clinical Pharmacy Services, Pharmacy Department, Hamad General Hospital, Hamad Medical Corporation, Doha, Qatar.

Received 5th April 2010. Accepted 10th May 2010.

Address correspondence and reprint request to: Dr. Imran F. Khudair, Clinical Pharmacy Services, Pharmacy Department, Hamad General Hospital, Hamad Medical Corporation, PO Box 3050, Doha, Qatar. Tel. +974 4392186/4392969. Fax. +974 4392253. E-mail: ikhudair@hmc.org.qa

Vitamin K antagonists (namely Warfarin in our institution) remain the main oral anticoagulation medications for the prevention and the treatment of various cardiac, thromboembolic and hypercoagulable diseases. Warfarin has a narrow therapeutic window and requires frequent monitoring and dose adjustments to

maintain its optimal anticoagulation effect.[1] The aim of monitoring the patient's international normalized ratio (INR) is to ensure minimizing the risk thromboembolic events without increasing the risk of bleeding complications or new clot formation.[1] Unwanted serious adverse events are most likely to occur during the period where the INR is outside the therapeutic range. Factors contributing to fluctuations in INR include irregular intake of vitamin K, patient compliance, warfarin-drug interactions, and inter-current disease.[2,3] Warfarin is also known as one of the drugs most frequently causing adverse drug reactions and admission to the hospital.[4] The adverse event reporting system from the American Food and Drug Administration (FDA) reveals that warfarin is among the top 10 drugs with the largest number of serious adverse events reported during the last 2 decades.[5] Like any other medication, patient counseling and education are important to ensure safe and effective treatment. Patient education is also one of the principal patient's rights. Tang et al[2] suggest that the patient's knowledge on warfarin therapy has an important impact on anticoagulation control. Patients who use warfarin should receive an educational session at the beginning of the therapy to ensure that the medication is taken correctly.[3] Barcellona et al[3] illustrated that adequate education concerning anticoagulation therapy resulted in a more effective and stable treatment. Moreover, adherence to medical treatment is enhanced by knowledge and understanding of the medication, its benefits, and side-effects.[6]

Therefore, healthcare providers should realize that many patients taking oral anticoagulants might have significant gaps in their warfarin-related knowledge. In addition, patients may have unsafe beliefs, which may still be present after receiving initial education on warfarin and frequent monitoring through an anticoagulation clinic.[7] Little is known about the level of knowledge and education of patients taking warfarin and followed in Hamad General Hospital (HGH) warfarin anticoagulation clinics. This study was undertaken to evaluate the quality of the patient's education and knowledge on warfarin, its association with INR, and clinical outcomes.

Methods. This cross-sectional study was carried out at Hamad Medical Corporation (HMC), Doha, Qatar between August 2008 to November 2008. Hamad Medical Corporation is a tertiary care teaching hospital with a total capacity of 1,600 beds. Medical and cardiology warfarin clinics (2 days per week for medical and 5 days per week for cardiology) are available in Hamad General Hospital, a 600-bed hospital. The patient population includes local as well as expatriates mainly from other Arab countries and Asia. Healthcare (including medication) is free for local population and highly subsidized for residents. A self-administered questionnaire consisting of 2 parts was developed. The first part included 8 questions on the patient's previous warfarin educational sessions and its importance, any bleeding or clot events during warfarin therapy, self-reported missing doses and the INR. The second part included 12 questions; 10 questions were derived from the oral anticoagulation knowledge (OAK) test developed by Zeolla et al.[8] The OAK covered the main topics on warfarin such as drug interactions, vitamin K and diet, INR interpretation, effect of missing dose and its management, as well as when the patient should seek immediate medical attention. The remaining 2 questions were asked: the action of warfarin and which healthcare provider to inform regarding the current use of warfarin. The complete questionnaire is shown in ***Appendix 1**. Most of our patients are Arabs, therefore we translated the questionnaire into Arabic language. Three medical professionals proficient in English and Arabic agreed on the overall translation of the questionnaire. Moreover, the questionnaires were reviewed and approved by an English/Arabic high school teacher to guarantee the correctness of both questionnaires and understanding by non-medical people.

In this study, the following criteria were applied: 1) Controlled INR: the patient has at least 5 INR values out of 6 consecutive clinical readings within the therapeutic range prior to study date. Therapeutic INR range was set on a patient by patient basis. 2) Satisfactory knowledge about warfarin: the patient answers at least 9 out of 12 questions (≥75%) of the second part of the questionnaire correctly. "Don't know" option was included to minimize guessing the response and it was scored as "incorrect". The patient population consisted of all patients attending medical warfarin clinics between 01 August and 30 September 2008 and cardiology warfarin clinics between 01 October and 30 November 2008. Inclusion criteria were: taking warfarin for at least 2 months, able to read and understand Arabic or English and willingness to complete the questionnaire. We excluded patients who recently started taking warfarin (<2 months), non-Arabic or non-English readers, and geriatric patients who came with assistance (due to their inability to answer the questionnaire). The patients completed the questionnaire only once regardless of their number of visits to the clinic during the study period. Upon completion of the questionnaire, the enrolled patients were given the correct answers, a warfarin educational package (developed by the clinical pharmacy services) including warfarin dietary instructions. Informed

*The full text including Appendix is available in PDF format on Saudi Medical Journal website (www.smj.org.sa)

consent was documented for each subject included in the study. The study was approved by the Institution's Medical Research Board (#8095/08), Doha, Qatar.

Descriptive statistical analysis was carried out using the Statistical Package for Social Sciences (SPSS version 16.0) and MegaStat (version 10.0). Where appropriate, values are expressed as percentage, mean ± SD or range. Associations between independent and dependent variables were assessed using t-tests for continuous variables and exact χ^2 tests for categorical variables. P-value ≤0.05 (2-tailed) was considered significant.

Results. A total of 378 patients attended the medical and cardiology warfarin clinics during the 4-month study period. One hundred and forty three patients (37.8%) accepted to complete the questionnaire (90 males and 50 females). Three male patients were excluded from the analysis because they did not complete the 2 months of warfarin therapy, 56 patients were non-Arabic or non-English readers, and 12 geriatric patients who came with assistance. Reasons for declining were patient no longer on warfarin (n=4), poor visual acuity (n=5), lack of time (n=31), or refused to participate (n=127). Demographic characteristics of the study population (n=140) are summarized in **Table 1**. The indications for and duration of warfarin therapy are shown in **Table 2**. One hundred and sixteen patients (83%) reported to receive previous warfarin education. The majority (n=68, 59%) was educated by physicians. Eighty-four patients (72%) were educated during their hospital stay and the time lapse since their last educational session was mainly ≥1 year (n=54, 46%). Patients preferred physicians as their warfarin educator (n=80, 57%). More details regarding preferred educator, timing of counseling and time lapsed since the last educational session are provided in **Table 3**. Almost all patients (n=138, 98.5%) report the importance and the

Table 1 - Characteristics of study population (n=140)

Characteristic	Number (%)	
Male	90	(64)
Female	50	(36)
Age (mean ± SD [range])	47.4±14.8 [17-75]	
Age group		
15-29 years	23	(16)
30-49 years	51	(36)
50-69 years	57	(41)
70-79 years	9	(6)
Education level		
Primary/Secondary	16	(11)
High school	49	(35)
University	75	(54)
Working	93	(66)
On chronic medications*	78	(56)
Language		
Arabic	107	(76)
English	33	(24)
Ethnicity		
Middle Easterners	90	(64)
African	16	(11)
South Asian	11	(8)
Southeast Asian	9	(6)
American/Canadian	7	(5)
European	7	(5)
Warfarin clinic		
Medical	71	(51)
Cardiology	69	(49)

* On chronic medication other than warfarin

Table 2 - Indications for and duration of Warfarin (n=140).

Characteristic	Number (%)	
Medical warfarin clinic (n=71)		
Thromboembolism	55	(77)
Deep venous thrombosis	39	(55)
Pulmonary embolism	8	(11)
Other thromboembolism[a]	8	(11)
Hypercoagulable state	16	(23)
Anti phospholipid syndrome	13	(18)
Other hypercoagulable state[b]	3	(4)
Cardiology clinic (n=69)		
Atrial fibrillation	30	(43)
Valve Replacement[c]	31	(45)
Others[d]	8	(12)
Warfarin therapy duration		
2-3 months	26	(19)
4-6 months	13	(9)
7-12 months	25	(18)
> 1 year	76	(54)

[a] Recurrent arterial venous fistula occlusion, mesenteric thrombus and cerebrovascular accident. [b] Two patients with prothrombin gene mutation and one with factor V leiden mutation. [c] Mitral valve replacement, aortic valve replacement or both. [d] Left ventricular thrombus, left ventricular assist device and ischemic cardiomyopathy.

Table 3 - Characteristics on warfarin educator, location, timing and patient's preference (n=140).

Characteristic	Number (%)	
Education performed by (n=116)		
Physicians	68	(59)
Pharmacists	25	(22)
Nurses	4	(3)
More than one healthcare provider	14	(12)
Others*	5	(4)
Counseling location (n=116)		
During hospital stay	84	(72)
In warfarin clinic	15	(13)
Pharmacy Counseling room	4	(3)
More than one location	8	(13)
Others	5	(4)
Last education was (n=116)		
In the last 2 months	31	(27)
In the last 6 months	25	(22)
One year or more	54	(46)
I don't remember	6	(5)
Patient's preference for warfarin educator (n=140)		
Physicians	80	(57)
Pharmacists	38	(27)
Nurses	2	(1)
More than one provider	20	(14)

*Others are 2 by dietitians, 3 through internet

need of education about warfarin. Self-reported bleeding during warfarin therapy cumulated to a total of 19 (13.6%) incidents of bleeding (6 lower gastrointestinal bleeding, 3 epistaxis, 3 hematuria, one from the eye, one bleeding gastric ulcer, and 5 were unspecified) while 3 patients suffered a new clot formation (2 recurrent deep venous thrombosis and one intra-cardiac thrombus). A total of 37 (26%) patients reported having missed at least one warfarin dose prior to the study period.

Patients were classified into 2 groups regarding their level of knowledge about warfarin, satisfactory knowledge group (SKG) and unsatisfactory knowledge group (UKG). There was a significant difference between the SKG and the UKG regarding their level of education ($p<0.0001$) with 98.7% of the SKG having a high school or higher educational level. All patients (n=79, 100%) in the SKG received warfarin education. Patient's INR in the SKG was better controlled ($p<0.0001$) and they spent more time within the therapeutic INR range during the 6 clinic visits prior to the study date ($p<0.0001$) compared with the UKG-patients. The most 3 incorrect answers on warfarin knowledge aspects in the SKG, and similarly in the UKG were warfarin-drug interactions, effect of a missing dose and its management, and whether or not healthcare providers should be informed on their current warfarin therapy. The number of clinic visits between the 2 groups (less clinic visits in SKG) was statistically significant ($p=0.0029$). Self-reported adherence, evaluated by asking the patients on the number of missing doses 2 months prior to the study period, was higher in SKG than UKG ($p=0.0231$). Thirty-one (22%) patients received their educational session within 2 months prior to the study period, 16 of them (36%) obtained a satisfactory knowledge score. An educational session 6 months ago in 25 patients, resulted in a satisfactory score in 14 (15%) patients, while an educational session of ≥1 year in 54 patients, resulted in a satisfactory knowledge score in 28 (65%) patients. Out of the 140 enrolled patients, 61 (44%) had a controlled INR value. Ninety-one patients (65%) mentioned not having difficulties in maintaining their INR within the therapeutic range. Out of this group, 44 patients (48%) were actually not controlled according to the study criteria. From the 24 patients who did not receive any warfarin education, 5 (26%) had a therapeutic INR-value, compared to 56 out of 116 (48%) who received education and had a therapeutic INR-value ($p=0.0136$). The knowledge level on different parameters between the SKG and USG is shown in **Figure 1**. Both patient groups were comparable regarding gender, language (Arabic or English), working or not, clinic type (medical or cardiology), or regarding the number of self-reported bleeding or clot events while on warfarin therapy (**Table 4**).

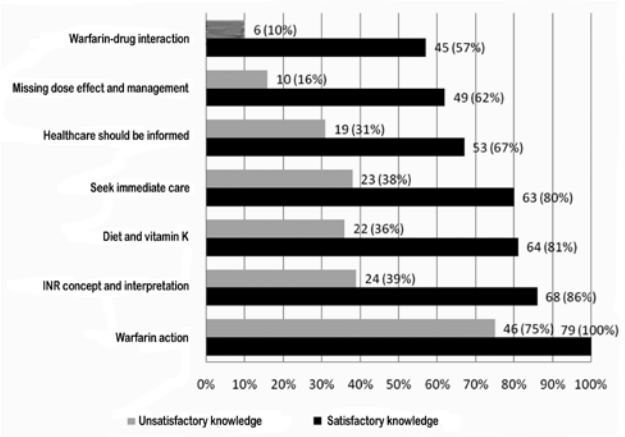

Figure 1 - Differences between "satisfactory knowledge group" and "unsatisfactory knowledge group" (n=140).

Discussion. This questionnaire based study helps to evaluate the patient's understanding regarding the important aspects of warfarin therapy. This kind of questionnaires is used to identify the patients' knowledge and their knowledge gaps that might exist in order to provide them with the information according to their needs.[9] Sufficient time between the patient and the healthcare provider in the clinic is essential to reveal and solve any therapy related inquiry the patient might have. However, physicians were the main educators in our study, a busy clinic may not allow time for proper counseling.[2] In addition, increasing complexity of medical care involving poly-pharmacy and complicated cases, physicians are concerned on the lack of time to provide adequate patient education for patients using warfarin.[1] A multidisciplinary approach including clinical pharmacists, nutrition specialists and nurses is likely to be more successful.[10] Patients taking warfarin may have significant knowledge gaps, particularly concerning drug-drug and drug-food interactions, and healthcare professionals must be aware of this.[9] Poor adherence to warfarin therapy was described by Kimmel et al[11] as significantly influencing anticoagulation control. This is even common when patients are seen in the anticoagulation clinic where adherence is stressed repeatedly throughout therapy.[11] To overcome these deficiencies, subsequent patient educational sessions should stress more on the aspects of adherence. Frequent blood test monitoring to measure INR has a negative impact on the quality of life of patients.[12] Patients may stay 30-45 minutes in the clinic for their INR measurement, physician's appointment, and dispensing their prescription. For patients with a therapeutic INR, the duration of the prescription will be longer with fewer clinic visits resulting in a substantial decrease in overall hospital service load and cost.[6] Our

Table 4 - Comparison of "satisfactory knowledge group" with "unsatisfactory knowledge group" (n=140):

Variable	Satisfactory knowledge group n=79 (%)		Unsatisfactory knowledge group n=61 (%)		*p* value*
Gender					0.5253
Male	49	(62)	41	(67)	
Female	30	(38)	20	(33)	
Language					0.2925
Arabic	63	(80)	44	(72)	
English	16	(20)	17	(28)	
Age (years) (mean ±SD [range])	45.2±14.9	[17-73]	50.4±14.2	[17-75]	0.0378
Working Status					0.3628
Working	55	(70)	38	(62)	
Not working	24	(30)	23	(38)	
Education level					<0.0001
Primary/Secondary	1	(1)	15	(25)	
High school/Higher education	78	(99)	46	(75)	
On chronic medications†	47	(59)	39	(64)	0.5925
Anticoagulation clinic					0.3169
Medical	43	(54)	28	(46)	
Cardiology	36	(46)	33	(54)	
Received education about warfarin therapy	79	(100)	24	(39)	<0.0001
INR controlled	49	(62)	12	(20)	<0.0001
Time spent on therapeutic INR in the last 6 clinic visits	73		53		<0.0001
Clinic visits in the previous 2 months† (mean ±SD [range]) (Lower number represent better controlled)	3.69±1.75	[1-10]	4.74±2.17	[2-10]	0.0029
Self-reported					
Adherence (Missed a dose or more in the last 2 months)	15	(19)	22	(36)	0.0231
Bleeding and Clot events while on warfarin	11	(14)	11	(18)	0.5077
Difficulties in maintaining INR within the range	24	(30)	25	(41)	0.1921

*Two-tailed p-value. †On chronic medications other than warfarin, INR - international normalized ratio.

data indicate that, despite a better control of INR in the patients who received education, the therapeutic value was obtained in 48% of patients only. This might be due to the fact that approximately 20% patients were only a few months on warfarin (rather than 4-6 months or more) or to the fact that the educational session needs to be improved and/or repeated at subsequent visits. Surprisingly, a recent educational session resulted 36% SKG compared to 15% of patients who were educated 6 months ago and 65% of patients educated one year (or longer) ago. This might be largely due to the small number of participants in each group and should not be generalized. Another striking fact is the young age for the patient population included in this study. This reflects the overall trend in this part of the world, but might also be due to the exclusion of some of the geriatric patients in this study. Therefore, it is also hard to tell whether or not younger patients would score better than geriatric patients in our setting. Patient's information retention about warfarin therapy may be affected with time. It is advisable to offer a refreshing educational session completed with handouts to patients on warfarin often.[7] Another option is providing warfarin guidance with each prescription emphasizing on the safety issues such as signs and symptoms of bleeding.[5] Improving patient's knowledge as part of the complete treatment plan may reduce the chances of major bleeding incidents.[5] Moreover, educating patients on the importance of seeking immediate medical advice when facing any signs or symptoms of bleeding, is a life saving matter. The educational system seems to predict the patient's knowledge on anticoagulation therapy.[13] An Australian study showed that patients who answered questions on warfarin correctly were: 13% with primary education, 30% with at least some secondary school education, and 41% with some tertiary education.[13] Levi et al[14] describe the usage of laboratory devices as part of self-testing and self-management of one's warfarin dose. This allows home testing and might be an alternative for anticoagulation clinics especially in well educated and adherent patients. The most vulnerable patients, being patients with a poor educational level, and geriatric patients, might need extra attention. Expansion of the education to their caregivers should be considered to ensure proper treatment.

Study limitations. The poor INR control might affect the number of clinic visits per patient. This combined with the high number of patients per clinic might have resulted in a "negative feeling" from the physician and the patient. A second limitation is the high number of patients refusing to complete the questionnaire and therefore limiting generalizabilty of our findings. This could have been reduced by a more convincing attitude, which needs improvement for further projects. Also the exclusion of geriatric patients who were unable to complete the questionnaire and

who are likely to be at higher risk for complications needs more attention. As these patients are taken care of by family members or other careers, these caregivers should be considered for completing the questionnaire. A third limitation was a language barrier for non-Arabic and non-English speaking patients. In our institution, comprehensive warfarin education packages have also been made available in Hindi, Malayalam and Urdu. Good communication between the physician and the patient is particularly important in chronic medical conditions. Nadar et al[15] demonstrated that patients felt more comfortable with physicians of the same ethnic group not only for language reasons, but also for asking questions. We plan to evaluate patients who communicate in other languages in future projects.

In conclusion, a multidisciplinary education program including clinical pharmacists may improve patients' warfarin knowledge, drug compliance, and ultimately result in a better anticoagulation control with fewer clinic visits and a reduction in healthcare service load. Education and re-education of patients on anticoagulation may assure a safer and more effective treatment. It may also detect patient misinterpretation and answer on any outstanding question patients might have. Special attention should be addressed to geriatric patients and to those patients with low educational level and language barriers. The possible impact of the multi-language educational package developed in our institution needs to be further evaluated.

Acknowledgment. *The authors would like to thank the clinicians and nurses in the warfarin clinics for allowing the clinical pharmacist to assess the knowledge of warfarin in their patients. They would also like to thank the patients for their collaboration.*

References

1. Fang MC, Machtinger EL, Wang F, Schillinger D. Health literacy and anticoagulation-related outcomes among patients taking warfarin. ***J Gen Intern Med*** 2006; 21: 841-846.
2. Tang EO, Lai CS, Lee KK, Wong RS, Cheng G, Chan TY. Relationship between patients' warfarin knowledge and anticoagulation control. ***Ann Pharmacother*** 2003; 37: 34-39.
3. Barcellona D, Contu P, Marongiu F. Patient education and oral anticoagulant therapy. ***Haematologica*** 2002; 87: 1081-1086.
4. Pirmohamed M, James S, Meakin S, Green C, Scott AK, Walley TJ, et al. Adverse drug reactions as cause of admission to hospital: prospective analysis of 18 820 patients. ***BMJ*** 2004; 329: 15-19.
5. Wysowski DK, Nourjah P, Swartz L. Bleeding complications with warfarin use: a prevalent adverse effect resulting in regulatory action. ***Arch Intern Med*** 2007; 167: 1414-1419.
6. Roche-Nagle G, Chambers F, Nanra J, Bouchier-Hayes D, Young S. Evaluation of patient knowledge regarding oral anticoagulants. ***Ir Med J*** 2003; 96: 211-213.
7. Mazor KM, Baril J, Dugan E, Spencer F, Burgwinkle P, Gurwitz JH. Patient education about anticoagulant medication: is narrative evidence or statistical evidence more effective? ***Patient Educ Couns*** 2007; 69: 145-157.
8. Zeolla MM, Brodeur MR, Dominelli A, Haines ST, Allie ND. Development and validation of an instrument to determine patient knowledge: the oral anticoagulation knowledge test. ***Ann Pharmacother*** 2006; 40: 633-638.
9. Jank S, Bertsche T, Herzog W, Haefeli WE. Patient knowledge on oral anticoagulants: results of a questionnaire survey in Germany and comparison with the literature. ***Int J Clin Pharmacol Ther*** 2008; 46: 280-288.
10. Henn Cde B, Rabelo ER, Boaz M, de Souza EN. Knowledge on chronic oral anticoagulation of patients followed up in a specialized outpatient clinic. ***Rev Gaucha Enferm*** 2008; 29: 207-213.
11. Kimmel SE, Chen Z, Price M, Parker CS, Metlay JP, Christie JD, et al. The influence of patient adherence on anticoagulation control with warfarin: results from the International Normalized Ratio Adherence and Genetics (IN-RANGE) Study. ***Arch Intern Med*** 2007; 167: 229-235.
12. Davis NJ, Billett HH, Cohen HW, Arnsten JH. Impact of adherence, knowledge, and quality of life on anticoagulation control. ***Ann Pharmacother*** 2005; 39: 632-636.
13. Effectiveness of anticoagulation among patients discharged from hospital on warfarin. The Newcastle Anticoagulation Study Group. ***Med J Aust*** 1998; 169: 243-246.
14. Levi M, de Peuter OR, Kamphuisen PW. Management strategies for optimal control of anticoagulation in patients with atrial fibrillation. ***Semin Thromb Hemost*** 2009; 35: 560-567.
15. Nadar S, Begum N, Kaur B, Sandhu S, Lip GY. Patients' understanding of anticoagulant therapy in a multiethnic population. ***J R Soc Med*** 2003; 96: 175-179.