Enhancing the Efficacy and Safety of Warfarin through Patient Education

Winifred Adadzi¹,⁵, Jerome Adadzi², Nicholas A Kerna³,⁴* and Orien L Tulp³

¹Lakeland Regional Medical Center, USA

²University of Science, Arts and Technology, Montserrat, BWI

³Faculty of Medicine, University of Science, Arts and Technology, Montserrat, BWI

⁴SMC Medical Research, Thailand

⁵AdventHealth Fish Memorial, USA

*Corresponding Author: Nicholas A Kerna, College of Medicine, University of Science, Arts and Technology, 5400 Ward Road Building 3-150 Arvada, CO 80002 USA. **E-mail:** nicholas.kerna@usat.edu

Abstract

Warfarin has been the leading oral anticoagulant agent for managing thromboembolic diseases for several decades. The number of patients receiving warfarin over the years has increased substantially with the elderly comprising a sizeable proportion. Polypharmacy is common in the elderly population; thus, these patients need to be well informed about warfarin and its various interactions with other medications. This retrospective research attempted to assess the general knowledge of warfarin in patients who had been treated with warfarin for six months to one year compared to patients treated with warfarin for more than one year. The results of this study indicated that there was a trend toward increasing knowledge with increasing duration of warfarin use in elderly patients. Also, the study suggested that continuing education regarding warfarin may further increase knowledge of the drug and its interactions with other medications in the elderly population over time.

Keywords: Anticoagulant; Patient education; Polypharmacy; Warfarin

Abbreviations

EP: Element of Performance; INR: International Normalized Ratio; IRB: Institutional Review Board; LRMC: Lakeland Regional Medical Center; NPSG: National Patient Safety Goal; OTC: Over-the-Counter

Introduction

There are currently about 35 million people in the United States who are older than 65 years of age. This number comprises 12.6% of the total population. The U.S Census Bureau estimates that this number will increase to 54 million (16.5%) by the year 2020, making this demographic the fastest growing age group [1].

Over the past several decades, warfarin has been the principal oral anticoagulant agent for managing thromboembolic diseases; such as chronic atrial fibrillation, mechanical valve replacement, deep vein thrombosis, pulmonary embolism, and vascular heart disease [2]. The number of patients receiving warfarin has increased substantially with the elderly comprising a sizeable share. Polypharmacy is common in the elderly population [3]. Thus, it is imperative that elderly patients are knowledgeable regarding warfarin's interactions with medications and diet in order to ensure the drug's safety and efficacy.

Some studies have suggested that the elderly were less knowledgeable about warfarin than younger patients. Therefore, it is vital for the clinician to give due attention to the elderly patient regarding warfarin. Tang et al. (2003) conducted a study at the Warfarin Clinic within a 1400- bed general teaching hospital. The researchers focused on the first eight weeks after patients had begun warfarin therapy and were returning for follow-up. This study evaluated both younger and older patients between 44–75 years of age. A set of nine questions assessed patient knowledge of warfarin. The researchers concluded that there was an inverse relationship between age and the knowledge score of the patient (r = 0.43; p < 0.001) [4].

A study by Hu et al. (2006) concluded that patients' knowledge—as well as drug compliance—improved after patient education became part of the discharge management [5]. In-hospital warfarin patient education played a role in increasing patients' knowledge resulting in successful anticoagulation [5]. Beier and Ackerman (2005) also suggested that prior knowledge about a topic was a critical and significant predictor of knowledge acquisition in the elderly [6]. Thus, in the hospital setting, asking patients about their warfarin knowledge can improve their understanding by reinforcing and building upon their prior knowledge of the drug.

The purpose of this study was to determine if elderly patients' knowledge about warfarin improves over time. The results from this study can be used to identify which areas to focus on when educating the elderly population about warfarin.

This retrospective study was performed at Lakeland Regional Medical Center (LRMC); a licensed 851 bed, community, not for profit, tertiary care hospital. The Joint Commission National Patient Safety Goal (NPSG.03.05.01) for anticoagulant therapy stated: "patient education is a vital component of an anticoagulation therapy program" [7]. The corresponding element of performance (EP #7) requires that patient education include the importance of follow-up monitoring, compliance, drug-food interactions, and potential for adverse drug interactions [7]. In order to meet this Joint Commission's directive, LRMC's goal is to educate all patients who are admitted and are taking warfarin.

Discussion

Methods

This study was a retrospective chart review of hospitalized patients at LRMC. The Institutional Review Board (IRB) approved this study. A multidisciplinary group of nurses, dieticians, pharmacists, prescribers, and social workers developed a warfarin knowledge screening tool (questionnaire). This screening tool (Figure 1 and 2) was used to assess patient knowledge of warfarin based on specific predetermined questions, which were deemed the minimum amount of patient knowledge for effective and safe warfarin use. These questions included patients knowing 1) their indication for warfarin, 2) why consistent INR (international normalized ratio) blood testing is essential, 3) the side effects of warfarin, 4) why it is crucial to speak with their physician before taking any new medications or herbal supplements, 5) and why patients should call their physician or clinic if they make significant changes to their diet.

Figure 1: *Lakeland Regional Medical Center screening tool for warfarin.*

1. Age
2. Gender
   a. Male
   b. Female
3. History of Warfarin Use
   a. 6 months-1year
   b. >1 yeae
4. Why are you currently taking Coumadin/Warfarin?
   a. Atrial Fibrillation
   b. Heart Valve Replacement
   c. Heart Failure
   d. DVT
   e. PE
   f. Unsure
5. Why is consistent INR blood testing at your Clinic important?
   a. Make sure my Coumadin/Warfarin/INR is not too high or low.
   b. Unsure
6. What are the side effects of Coumadin/Warfarin?
   a. Easy bruising, excessive bleeding, or red/dark stools.
   b. Unsure
7. Why should you speak with your Physician/Clinic before taking any new medications or herbal supplements? (e.g. OTC pain relievers or herbals recommended by a friend)
   a. It can affect my Coumadin/Warfarin/INR levels.
   b. Unsure
8. Why should you call your Physician/Clinic if you make drastic changes to your diet (e.g. starting a new weight loss diet or sick/unable to eat for >3-4 days)
   a. It can affect my Coumadin/Warfarin/INR levels.
   b. Unsure
9. English as primary language
   a. Yes
   b. No
10. Discharged to a Coumadin Clinic
    a. Yes
    b. No

Figure 2: Data collection form.

Inclusion criteria

Subjects for inclusion were identified from a Cerner report of patients 65 years of age or older who received warfarin for nine months (from January 2010 to September 2010). Approximately 900 patients on warfarin therapy were identified. However, only those patients who had a warfarin screening tool in their record (indicating they had been screened and educated) were included. For patients with multiple admissions, only the first qualifying admission was considered. Patients were assigned into two groups: those who had been on warfarin for six months to one year and those who had been on warfarin for longer than one year. This six-month cut-off was chosen to allow time for patients to visit a warfarin clinic or refill their prescriptions, allowing them an opportunity to learn more about their warfarin therapy.

Exclusion criteria

Patients admitted from or discharged to nursing homes and long-term care facilities were excluded from this study since they would be cared for by other healthcare providers. This exclusion limited the study population to patients who would benefit most from warfarin education.

Data collection

Answers to questions 2–6 on the screening tool were used to determine each patient's knowledge (Figure 1). A patient correctly answering all five questions was considered knowledgeable. The average score for each group was calculated based on the total number of questions (out of the five questions) that were answered correctly. The patient medical profiles were reviewed further to determine the indication for warfarin therapy, gender, history of warfarin use, patient's primary language, and whether or not they were being referred to a warfarin clinic.

Efficacy and safety endpoints

The primary endpoint was to assess the overall knowledge of patients based on a set of five questions. The secondary endpoint was to analyze the knowledge of each question individually.

Statistical analysis

The two groups were compared using Chi-Squared (X^2) analysis with significance defined as $P \le 0.05$. Descriptive statistics were used to report patient demographics and responses to questions between the two groups. Also, the two groups were compared to determine how they answered each question. One hundred and fifty patients were needed to detect a 5% difference at the 95% confidence level. The questions were further evaluated to determine which questions patients missed the most.

Results

Approximately 58% of patients in the 6-months to $\le$ 1-year group and 70% of patients in the > 1-year group were knowledgeable about warfarin; with a p-value of 0.53. Overall knowledge difference, for gender, was similar between the two groups, with both groups improving over time (Figure 3).
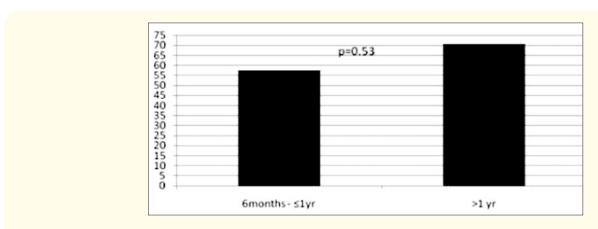

Figure 3: Percent of patient knowledge by duration of therapy.

The mean age for the 6-months to $\le$ 1-year group and the > 1-year group was 72.4 ± 5.17 and 72.7 ± 5.8, respectively (Table 1). Patients who were on warfarin for atrial fibrillation (the second highest indication for warfarin) were 27% and 40% for the 6-months to $\le$ 1-year group and the > 1-year group, respectively. Those patients on warfarin for heart failure were 33% and 41% for the 6-months to $\le$ 1-year group and the > 1-year group, respectively. Those patient uncertain why they were on warfarin were 17% and 6% in the 6-months to $\le$ 1-year group and the > 1-year group, respectively.

Parameter	6 months to ≤ 1 year			> 1 yr		
	Men (n = 39)	Women (n = 37)	Total (n = 75)		Women (n = 36)	Total (n = 75)
Age (Mean ± 5D)	72.7 ± 4.81	72 ± 6.13	72.35 ± 5.5	72.7 ± 6.43	72.75 ± 5.07	72.7 ± 5.8
Indication, n (%)						
Atrial Fibrillation	9(24%)	11(30%)	20 (27%)	13 (33%)	17 (47%)	30(40%)
Heart Valve Replacement	1 (3%)	3 (8%)	4 (5%)	4 (10%)	1 (3%)	5 (7%)
Heart Failure	13 (34%)	12(32%)	25 (33%)	17 (44%)	14 (39%)	31(41%)
DVT	6 (16%)	2 (5%)	8 (11%)	1 (3%)	2 (6%)	3 (4%)

PE	2 (5%)	3 (8%)	5 (7%)	0 (0%)	0 (0%)	0
Other	7 (18%)	6 (16%)	13 (17%)	4 (10%)	2 (6%)	6 (8%)
English as primary language						
Yes	36 (95%)	36(97%)	72 (96%)	37 (95%)	33 (92%)	70(93%)
No	2 (5%)	1 (3%)	3 (4%)	2 (5%)	3 (8%)	5 (7%)
Discharged to a Coumadin / Warfarin Clinic						
Yes	17 (45%)	15(41%)	32 (43%)	17 (44%)	17 (47%)	33(44%)
No	21 (55%)	22(59%)	43 (57%)	22 (56%)	19 (53%)	42(56%)

Table 1: The demographics for patients on warfarin 6 months to ≤ 1 year and > 1 year.

Patients in the > 1-year group answered each question correctly, more than patients in the 6-months to ≤ 1-year group (Figure 4). There was an improvement in knowledge for each question over time. Awareness of the impact that diet had on warfarin had the lowest score initially but was most improved over time. The impact diet had on warfarin was recognized by 82% of males in the > 1-year group compared to 70% of females in the same group (Figure 5 and 6). About 67% of males in the > 1-year group knew why consistent INR monitoring was essential compared to about 79% of females within the same group. In the 6-months to ≤ 1-year group, 60% of males knew the importance of speaking with their doctor or pharmacist before starting any over-the-counter (OTC) medication or herbal supplement compared to 70% of females within the same group.
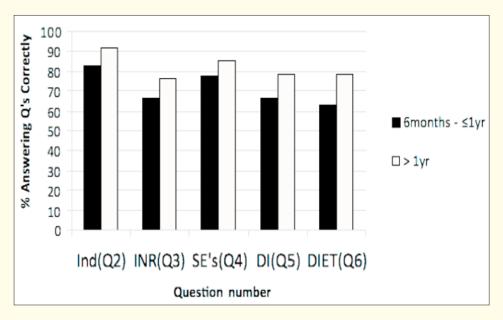

Figure 4: Overall patient knowledge of warfarin by question.
Note. *Definitions of Abbreviations. Ind (Q 2): Why are you currently taking coumadin/warfarin? INR (Q 3): Why is consistent INR blood testing at your clinic important? SE's (Q 4): What are the side effects of coumadin/warfarin? DI (Q 5): Why should you speak with your physician or clinic before taking any new medications or herbal supplements (e.g. OTC pain relievers or herbal supplements)? DIET*
(Q 6): Why should you call your physician or clinic if you make drastic changes to your diet (e.g. starting a new weight-loss diet or are sick or unable to eat for more than 3-4 days)?

Figure 5: *Male patient knowledge of warfarin by question.*
Note: *Definitions of Abbreviations. Ind (Q 2): Why are you currently taking coumadin/warfarin? INR (Q 3): Why is consistent INR blood testing at your clinic important? SE's (Q 4): What are the side effects of coumadin/warfarin? DI (Q 5): Why should you speak with your physician or clinic before taking any new medications or herbal supplements (e.g. OTC pain relievers or herbal supplements)? DIET (Q 6): Why should you call your physician or clinic if you make drastic changes to your diet (e.g. starting a new weight-loss diet or are sick or unable to eat for more than 3-4 days)?*
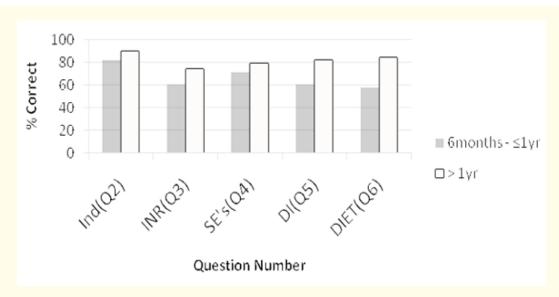

Figure 6: *Female patient knowledge of warfarin by question.*
Note: *Definitions of Abbreviations. Ind (Q 2): Why are you currently taking coumadin/warfarin? INR (Q 3): Why is consistent INR blood testing at your clinic important? SE's (Q 4): What are the side effects of coumadin/warfarin? DI (Q 5): Why should you speak with your physician or clinic before taking any new medications or herbal supplements (e.g. OTC pain relievers or herbal supplements)? DIET (Q 6): Why should you call your physician or clinic if you make drastic changes to your diet (e.g. starting a new weight-loss diet or are sick or unable to eat for more than 3-4 days)?*
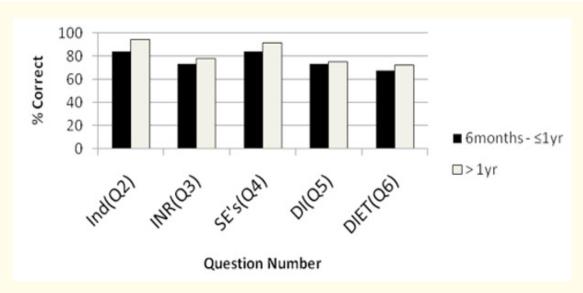
Limitations of this study

The screening tool used to assess patients was not a validated tool. The sample size might not have been adequate to achieve power. Also, the number of questions patients needed to answer correctly—in order to be deemed knowledgeable—was not validated. Patients were required to answer all five questions correctly in order to be deemed knowledgeable. The investigators assumed that, by six months, patients would have had the opportunity to visit a warfarin clinic, visit their doctor's office, or have their medications refilled at a local pharmacy; thus gaining additional familiarity with warfarin from the staff at such places.

Summary

This study helped determine how knowledgeable elderly patients (admitted to LRMC) were regarding warfarin. The results of this study indicated that, in elderly patients, there was a trend toward an expanded understanding of warfarin with longer duration of its use; although the results were not statistically significant. Seventy percent of patients on warfarin for greater than one year were more knowledgeable compared to 58% of patients on warfarin for 6 months to ≤ 1 year, with a p-value of 0.53.

Overall knowledge of warfarin was higher in patients on warfarin for > 1 year for all questions (Figure 4). Patients on warfarin for 6 months to ≤ 1 year, answered questions incorrectly more often than those on warfarin for > 1 year. More patients in the 6-months to ≤ 1-year group did not recognize the impact that diet had on warfarin therapy. The average score for patients on warfarin for 6 months to ≤ 1 year and those on warfarin >1 year was 57% and 72%, respectively. Approximately 21% of the patients in the > 1-year group did not know the importance of consulting with their physician or clinic personnel before taking new medications or herbal supplements. The importance of INR testing was unknown to 24% of patients in the > 1-year group. Forty- three percent of patients in the 6-months to ≤ 1-year group and 44% of patients in the > 1-year group were discharged to a warfarin clinic.

Conclusion

Warfarin is the anticoagulant of choice for the management of various thromboembolic diseases. With polypharmacy common in the elderly population, these patients need to be well informed about warfarin and its various interactions with other medications. Thus, patients' "warfarin knowledge" is fundamental to the success of warfarin therapy, especially in the elderly.

The Joint Commission NPSG regarding anticoagulation reasons that the use of a standardized practice that includes patient involvement can reduce the risk of adverse events related to warfarin use. This retrospective study utilized a standardized screening tool and involved patients during warfarin education. An improvement in warfarin knowledge was noted in patients on warfarin more than one year. Thus, efforts should be made by healthcare providers to educate and inform elderly patients regarding their warfarin therapy continually.

Although there were limitations to this study and some findings were not statistically significant, the overall results suggested that continuing education regarding warfarin use may further improve knowledge in the elderly population over time and contribute to the drug's efficacy and safety in this at-risk population.

Conflict of Interest Statement

The authors declare that this paper was written in the absence of any commercial or financial relationship that could be construed as a potential conflict of interest.

Acknowledgement

References

1. US Census Bureau. "Population estimates". Washington, DC: US Census Bureau (2000). https://www.census.gov/programs-surveys/popest.html

2. Yahaya AHM., *et al*. "Factors associated with warfarin therapy knowledge and anticoagulation control among patients attending a warfarin clinic in Malaysia". *Journal of Clinical and Diagnostic Research* 3.4 (2009): 1663-1670. https://www.researchgate.net/publication/279762564_Factors_associated_with_warfarin_therapy_knowledge_and_anticoagulation_control_among_patients_attending_a_warfarin_clinic_in_Malaysia

3. Chung MK and Bartfield JM. "Knowledge of prescription medications among elderly emergency department patients". *Annals of Emergency Medicine* 39.6 (2002): 605-608. https://www.ncbi.nlm.nih.gov/pubmed/12023702

4. Tang YL., *et al*. "Relationship between patients' warfarin knowledge and anticoagulation control". *Annals of Pharmacotherapy* 37.1 (2003): 34-39. https://www.ncbi.nlm.nih.gov/pubmed/12503930

5. Hu A., *et al*. "Factors influencing patient knowledge of warfarin therapy after mechanical heart valve replacement". *Journal of Cardiovascular Nursing* 21.3 (2006): 169-175. https://www.ncbi.nlm.nih.gov/pubmed/16699355

6. Beier M and Ackerman PL. "Age, ability, and the role of prior knowledge on the acquisition of new domain knowledge: Promising results in a real- world learning environment". *Psychology and Aging* 20.2 (2005): 341-355. https://www.ncbi.nlm.nih.gov/pubmed/16029097

7. The Joint Commission National Patient Safety Goals (NPSGs) (2011). http://smeyerholtz.weebly.com/uploads/1/1/3/0/11309249/the_joint_commission_ppt.pptx