Guideline-Discordant Periprocedural Interruptions in Warfarin Therapy

Lesli E. Skolarus, MD, MS; Lewis B. Morgenstern, MD; James B. Froehlich, MD, MPH; Lynda D. Lisabeth, PhD; Devin L. Brown, MD, MS

Background—Periprocedural interruptions in warfarin therapy increase thromboembolic risks to patients and are not indicated for all procedures. We sought to determine the frequency and guideline concordance of periprocedural warfarin interruptions to inform a future educational intervention.

Methods and Results—In October and November of 2009, an anonymous postal survey was sent to all patients followed for more than 1 year by the University of Michigan Anticoagulation service. Patients were asked how many times in the prior year they were requested to interrupt warfarin therapy for a medical or dental procedure or test and the specific indication for the requested interruption in warfarin therapy. A total of 1686 of 2133 (79%) subjects responded. The mean age of respondents was 69 years (SD=14 years). The majority were men (56%) and white (93%). Atrial fibrillation was the most common indication for warfarin therapy (n=966, 57%). At least 1 request to interrupt warfarin therapy in the prior year was given by 819 of 1648 (50%) respondents, including 481 of the 947 (51%) respondents taking warfarin for atrial fibrillation. Forty-eight percent of requests to interrupt warfarin among all respondents and 50% of requests to interrupt warfarin among those taking warfarin, specifically for atrial fibrillation, were for indications not supported by guideline statements.

Conclusions—Periprocedural requests to interrupt warfarin therapy are common and are often discordant with current guidelines. Educational interventions may decrease risk of periprocedural thromboembolic complications. (Circ Cardiovasc Qual Outcomes. 2011;4:206-210.)

Key Words: anticoagulants □ arrhythmia □ stroke □ prevention

More than 30 million warfarin prescriptions are dispensed annually in the United States to prevent thromboembolism. During interruptions in warfarin therapy, many of which occur in the setting of medical procedures, patients are left vulnerable to thromboembolic events. To decrease the risk of periprocedural thromboembolic events, including stroke, it is imperative to understand periprocedural anticoagulation management.

The American College of Chest Physicians (ACCP) in 2008 and the American Society for Gastrointestinal Endoscopy (ASGE) in 2002 recommended continuing anticoagulation for dental procedures, dermatologic procedures, cataract extraction, and colonoscopy (Table 1). These minor procedures comprise up to 30% of procedures among anticoagulated patients. Unfortunately, surveys of physicians and dentists have shown that warfarin is often inappropriately interrupted for procedures, in contradiction to guideline statements.

Previous studies have shown that periprocedural interruptions of warfarin therapy result in up to a 1% risk of thromboembolism. However, the frequency and guideline concordance of warfarin therapy interruptions due to dental and medical procedures are not well known. To inform future interventions aimed at reducing inappropriate periprocedural interruptions in warfarin therapy and their known complications, we conducted a survey of patients cared for by an anticoagulation service. We hypothesized that anticoagulated patients, including those anticoagulated for atrial fibrillation, are frequently asked to discontinue warfarin for dental and medical procedures. We also hypothesized that many of these interruptions in warfarin therapy are for guideline discordant indications, resulting in needless vulnerability to stroke and other thromboembolic events.

Methods

Subjects
Patients from the University of Michigan Anticoagulation Service were queried using a postal survey with a promise of anonymity. The anticoagulation service treats approximately 3400 patients who primarily live in Southeast Michigan. All patients have a University
of Michigan physician who prescribes warfarin therapy. Currently, the anticoagulation service monitors and adjusts warfarin dosing but does not make decisions regarding the periprocedural management of warfarin therapy. These decisions are made by the prescribing or consulting physician.

WHAT IS KNOWN

- Warfarin is commonly prescribed in the United States.
- Current guidelines recommend continuing warfarin in the setting of dental, dermatologic, and cataract procedures.
- Periprocedural interruptions in warfarin result in up to a 1% risk of thromboembolism.
- Proceduralists often require patients to discontinue warfarin for procedures for which guideline statements suggest warfarin continuation.

WHAT THE STUDY ADDS

- Fifty percent of patients receiving chronic anticoagulation were asked to interrupt warfarin for a medical or dental procedure in a year.
- Nearly half (48%) of the periprocedural requests to interrupt warfarin were discordant with the prevailing guidelines.
- Models that included demographics and stroke risk did not predict requests for periprocedural warfarin interruptions.

Surveys were mailed to all living anticoagulation service patients who had been followed by the service for a minimum of 1 year (n=2133). A follow-up postcard was mailed approximately 1 week after the first survey mailing and a second round of surveys was mailed 1 month after the initial mailing. The mailings took place in October and November of 2009. Anticoagulation service staff members were permitted to remind patients to complete the survey during routine clinical telephone conversations. No incentives were provided. The study was approved by the University of Michigan Institutional Review Board, using a waiver of documentation of informed consent. All elements of informed consent were provided. The survey queried information on demographics, vascular risk factors, and indications for taking warfarin. Atrial fibrillation as a vascular risk factor and atrial fibrillation as an indication for warfarin administration were queried separately. Patients were asked how many times in the prior 12 months they were asked to interrupt warfarin therapy for a specific reason(s) for the requested interruption in warfarin therapy. Response options were colonoscopy, dental cleaning, other dental, and “other” with a write-in option. The “other” responses were grouped into 9 general categories (Table 2).

Survey

An introductory letter that accompanied the surveys outlined the elements of informed consent. The survey queried information on demographics, vascular risk factors, and indications for taking warfarin. Atrial fibrillation as a vascular risk factor and atrial fibrillation as an indication for warfarin administration were queried separately. Patients were asked how many times in the prior 12 months they were asked to interrupt warfarin therapy for a medical or dental procedure or test. Patients were also asked to recall the specific reason(s) for the requested interruption in warfarin therapy. Response options were colonoscopy, dental cleaning, other dental, and “other” with a write-in option. The “other” responses were grouped into 9 general categories (Table 2).

Statistical Analysis

Descriptive statistics were used to assess patient demographics, presence of vascular risk factors (yes versus no and missing), and

### Table 1. Guidelines Recommending Periprocedural Continuation of Warfarin Therapy

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Guideline Recommendation</th>
<th>Level of Evidence</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor dental procedure</td>
<td>Continue warfarin</td>
<td>Grade 1B</td>
<td>Grade 1 recommendations are considered strong and indicate that the benefits do (or do not) outweigh risks, burden, and costs.</td>
</tr>
<tr>
<td>Minor dermatologic procedures</td>
<td>Continue warfarin</td>
<td>Grade 1C</td>
<td>Grade 1 recommendations are considered strong and indicate that the benefits do (or do not) outweigh risks, burden, and costs.</td>
</tr>
<tr>
<td>Minor ophthalmologic procedures</td>
<td>Continue warfarin</td>
<td>Grade 1C</td>
<td>Grade 1 recommendations are considered strong and indicate that the benefits do (or do not) outweigh risks, burden, and costs.</td>
</tr>
<tr>
<td>Low-risk endoscopy procedures</td>
<td>Continue warfarin</td>
<td>Not included in the guideline</td>
<td></td>
</tr>
</tbody>
</table>

EGD indicates esophagogastroduodenoscopy; ERCP, endoscopic retrograde cholangiopancreatography.
indications for warfarin use. Median and interquartile ranges (IQR) were calculated for the number of requests for warfarin therapy interruptions. The indications for temporary interruption of warfarin therapy were assessed using frequencies and percents. Because atrial fibrillation is a common indication for warfarin and the risks and benefits of withholding warfarin can be more clearly estimated for a single indication, the analyses were therefore repeated in the subset of respondents prescribed warfarin for atrial fibrillation. Colonoscopy, cataract removal, dental, and dermatologic procedures were designated as guideline-discordant indications.

Table 3. Demographics and Vascular Risk Factors Among Patients Cared for by an Anticoagulation Service and Among the Subgroup Anticoagulated for Atrial Fibrillation

<table>
<thead>
<tr>
<th>Variable</th>
<th>All Respondents (n=1686)</th>
<th>Respondents Anticoagulated for Atrial Fibrillation (n=966)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male sex</td>
<td>927 (56)</td>
<td>587 (62)</td>
</tr>
<tr>
<td>Age</td>
<td>69 (14)</td>
<td>74 (11)</td>
</tr>
<tr>
<td>Race</td>
<td>White</td>
<td>1555 (93)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>Non-Hispanic</td>
<td>1535 (98)</td>
</tr>
<tr>
<td>Risk factors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>1069 (63)</td>
<td>674 (70)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>354 (21)</td>
<td>217 (22)</td>
</tr>
<tr>
<td>Heart disease</td>
<td>782 (46)</td>
<td>522 (54)</td>
</tr>
<tr>
<td>High cholesterol</td>
<td>733 (43)</td>
<td>414 (43)</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>1060 (63)</td>
<td>N/A</td>
</tr>
<tr>
<td>Stroke/TIA</td>
<td>383 (23)</td>
<td>228 (24)</td>
</tr>
<tr>
<td>Sleep apnea</td>
<td>370 (22)</td>
<td>219 (23)</td>
</tr>
</tbody>
</table>

TIA indicates transient ischemic attack.

In model 1, multivariable logistic regression was used to explore the association between demographics (age treated continuously, sex) and vascular risk factors (hypertension, diabetes, coronary disease, hyperlipidemia, atrial fibrillation, stroke/transient ischemic attack, sleep apnea) and requests for periprocedural warfarin interruption (dichotomous). In model 2, a multivariable logistic regression model was used to test the association between periprocedural requests for warfarin interruption (dichotomous) and the indication for warfarin, adjusting for demographics (age treated continuously, sex). The indications for warfarin were dichotomized into high thrombotic risk (atrial fibrillation with a history of stroke/transient ischemic attack or mechanical heart valve), and all other indications. Odds ratios (OR) with 95% confidence intervals (CI) were calculated. The predictive validity of the models was evaluated using the c statistic. A c statistic of 0.5 indicates that the model’s prediction was no better than chance, whereas a c statistic of 1 indicates perfect model discrimination. Analyses were performed using TIBCO Spotfire S +8.1 for Windows.

Results

Baseline demographics and vascular risk factors of the 1686 respondents (79% response rate) are summarized in Table 3. The mean age of the respondents was 69 years (SD=14 years), and more than half (56%) were men. Ninety-three percent of the survey respondents were white. The majority of respondents had a history of hypertension (63%). Nearly two-thirds of respondents (63%) reported a history of atrial fibrillation, and 57% identified it as the indication for anticoagulation therapy. As shown in Table 4, the other common indications for warfarin therapy included pulmonary embolism, deep venous thrombosis, and stroke.

A total of 819 of 1648 (50%) respondents had at least 1 request for a periprocedural interruption in warfarin therapy during the prior 12 months. There were a total of 1401 periprocedural requests to interrupt warfarin therapy among the 1648 respondents. On average, each respondent had 0.85 (SD=1.2) (median, 0; IQR, 0 to 1) periprocedural requests to interrupt warfarin.

Among those respondents reporting atrial fibrillation as their indication for warfarin therapy, 481 of 947 (51%) had at least 1 request to interrupt warfarin therapy. There were 798 requests to interrupt warfarin among the 947 respondents. On average, each respondent had 0.84 (SD=1.1) (median, 1; IQR, 0 to 1) periprocedural requests to interrupt warfarin.

Among all requests for interruption of warfarin therapy, those for dental procedures (a combination of dental cleaning and other dental procedures) were the most common (26%, n=368), followed by surgery (20%, n=286) and colonoscopy (18%, n=259) (Table 2). Nearly half (48%, n=694) of all requests to interrupt warfarin therapy were for guideline-discordant indications. A similar proportion (50%, n=417) of requests to interrupt warfarin therapy for respondents anticoagulated for atrial fibrillation were also discordant with current guidelines.

Results of the multivariable logistic regression models to explore predictors of requests to interrupt warfarin are shown in Table 5. In model 1, age (OR, 0.99; 95% CI, 0.98, 1.0), heart disease (OR, 1.29; 95% CI, 1.05, 1.59), and high cholesterol (OR, 1.32; 95% CI, 1.07, 1.63) were significantly associated with a request for warfarin interruption. However, this demographic and vascular risk factor model performed poorly (c=0.58). In model 2, after adjustment for demographics, a high-risk indication for warfarin was not associated with a request to interrupt warfarin (OR, 0.96; 95% CI, 0.76, 1.21). This model also performed poorly (c=0.54).

Discussion

This survey of patients cared for by an academic anticoagulation service reveals that medical and dental providers’ requests to interrupt warfarin are often discordant with current guidelines. In our study, nearly 50% of the requests to

Table 4. Indications for Warfarin Therapy Among the 1686 Respondents

<table>
<thead>
<tr>
<th>Indication</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atrial fibrillation</td>
<td>966 (57)</td>
</tr>
<tr>
<td>PE/DVT</td>
<td>398 (24)</td>
</tr>
<tr>
<td>Stroke</td>
<td>229 (14)</td>
</tr>
<tr>
<td>Mechanical valve</td>
<td>182 (11)</td>
</tr>
<tr>
<td>Cardiomyopathy</td>
<td>178 (11)</td>
</tr>
<tr>
<td>Peripheral emboli</td>
<td>84 (5)</td>
</tr>
<tr>
<td>Rheumatic heart disease/mitral stenosis</td>
<td>71 (4)</td>
</tr>
<tr>
<td>Orthopedic procedure</td>
<td>33 (2)</td>
</tr>
<tr>
<td>Other</td>
<td>245 (15)</td>
</tr>
</tbody>
</table>

PE indicates pulmonary embolism; DVT, deep venous thrombosis.

Some respondents provided more than 1 indication.
interrupt warfarin therapy within the previous year were discordant with the ACCP and ASGE guidelines.2,3 Unfortunately, other studies have also shown low adherence to these guidelines. Surveys of Oral and Maxillofacial Surgeons and Dermatologists revealed that 24% to 71% recommend dismounting warfarin therapy before their procedures.6,7 Even more compelling is a prospective registry of patients undergoing cataract surgery in the United States and Canada, which found that more than one-fourth of patients interrupted warfarin therapy before their procedures.8 We suspect that this may be because the guidelines are subject to change, as with the ACCP and ASGE guidelines.2,3 Unfortu-

nantly, strategies that improve patient reporting of requests for periprocedural warfarin therapy interruption to the anticoagulation service in real time, or the occurrence of procedures without requests to interrupt warfarin. We did not ask about any medical consequences of warfarin inter-

ruption. Because we did not query duration of warfarin use, previous warfarin interruptions and their outcomes, or information about congestive heart failure to calculate a CHADS2 score, we were unable to explore these as predictors of guideline-discordant interruptions of warfarin for commonly performed procedures may help limit patient risk. Addition-

ally, strategies that improve patient reporting of requests for warfarin therapy interruption to the anticoagulation service may be helpful.

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**Disclosures**

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**References**


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