Comparison of Anticoagulation Clinic Patient Outcomes With Outcomes From Traditional Care in a Family Medicine Clinic

Marvin A. Chamberlain, RPh, MS, Nannette A. Sageser, Pharm D, and David Ruiz, MD

Background: **Giving patients oral anticoagulation therapy in an ambulatory clinic setting is associated with substantial risk of adverse outcomes leading to emergency department visits and unplanned inpatient admissions. This article describes an effectiveness study conducted in a well-characterized family practice setting that compares anticoagulation outcomes in patients managed by a traditional care model with outcomes obtained with an anticoagulation clinic model.**

Methods: **All study patients received continuous anticoagulation care at the Family Medicine of Southwest Washington (FMSW) clinic during the 1-year study period. The method was retrospective and used linked record review, including outpatient, inpatient, and emergency department records. Patients were divided into two groups as naturally observed: those treated in the clinic by traditional care compared with those treated in an anticoagulation clinic model. Data analyses compared the two groups in terms of patient demographics, anticoagulation control, and inpatient admissions and emergency department visits that were related to clotting or bleeding events.**

Results: **There were no differences in demographic variables between the anticoagulation clinic and traditional care groups. There was a statistically significant difference in anticoagulation control as measured by international normalized ratio (INR) values. The anticoagulation clinic group had fewer INR values outside the target range, ± 0.1, than the traditional care group (40.4% vs 47.3% $P = .022$). The anticoagulation clinic group also had significantly fewer INR tests drawn more than 6 weeks apart than the traditional care group (3.7% vs 8.1% $P = .01$). There was no statistically significant difference in emergency department visit rates caused by adverse events. Inpatient admission rates for the anticoagulation clinic and traditional care groups were not statistically different; however, they were clinically different (4.7 vs 19.7 admissions per 100 patient years of therapy $P = .15$).**

Conclusions: **More anticoagulation patients treated by the anticoagulation clinic model at FMSW received an INR test at least every 6 weeks than those treated by the traditional care model, and more of their INR results were within target range ± 0.1 when compared with the traditional care model. (J Am Board Fam Pract 2001;14:16–21.)**

In most clinic situations, management of oral anticoagulation therapy is undertaken by the patient's personal physician (traditional care).[1] An alternative is an anticoagulation clinic model staffed by pharmacists, nurses, or other nonphysician providers who, working cooperatively with each patient's physician, use dosing protocols and other techniques to care for anticoagulation patients. The Fifth American College of Chest Physicians Consensus Conference on Antithrombotic Therapy concluded that, based on observational studies, anticoagulation clinic models achieve better therapeutic outcomes than those achieved by traditional care.[2] Pharmacist-staffed anticoagulation clinic models point to more consistent monitoring, use of warfarin dosage adjustment algorithms, early recognition of patient risk factors, and patient education as the mechanisms by which they achieve better outcomes than were being achieved through traditional models of care.[3–6]

Submitted, revised, 31 May 2000.

From the Pharmacy Department (MAC), Southwest Washington Medical Center, the Anticoagulation Service at Family Medicine of Southwest Washington (NAS), Family Medicine of Southwest Washington (DR), and the Family Medicine Residency Program at Family Medicine of Southwest Washington (DR), Vancouver, Wash; and the Department of Family Medicine (DR), University of Washington School of Medicine, Seattle. Address request reprints to Nannette A. Sageser, Pharm D, Pharmacy Department, Southwest Washington Medical Center, PO Box 1600, Vancouver, WA 98668.

Financial Support for this study was provided entirely by Southwest Washington Medical Center.

At Family Medicine of Southwest Washington (FMSW), a decision was made in October 1996 to use an anticoagulation clinic model staffed by pharmacists to manage oral anticoagulation therapy for some patients. Initially, most anticoagulation patients cared for by FMSW attending physicians were assigned to anticoagulation clinic management. Patients cared for by family practice residents and by some attending physicians continued as traditional care patients. Between November 1996 and October 1997, some traditional care patients whose therapy was difficult to manage or who were noncompliant with follow-up visits were transferred from the traditional care to the anticoagulation clinic group.

The anticoagulation clinic at FMSW was designed to provide care for patients in the clinic. Patients are scheduled for a 15-minute clinic visit with a specially trained pharmacist. A fingerstick prothrombin time is measured, the patient is assessed for risk factors, and personalized education is provided. Based on the prothrombin time results, warfarin dosing is adjusted and follow-up appointments are scheduled. The clinic generates revenue from each anticoagulation clinic visit. In contrast, the traditional care model requires the patient to have blood drawn by venipuncture and prothrombin time is measured at the clinic laboratory. Within 24 hours, a laboratory report is sent to the physician's office for interpretation. Adjustments in therapy and education are provided by telephone, which is not a billable service.

We undertook a study to determine whether the anticoagulation clinic or traditional care model resulted in better outcomes for FMSW patients. The following four key study outcomes were selected to compare the two groups in terms of anticoagulation control and adverse events resulting from anticoagulation therapy:

1. Percentage of international normalized ratio (INR) values outside the target range ± 0.1
2. Percentage of INR tests drawn more than 6 weeks apart
3. Inpatient admissions as a result of bleeding or thromboembolic complications
4. Emergency department visits as a result of bleeding or thromboembolic complications

Methods

Family Medicine of Southwest Washington is a community-based, University of Washington-affiliated family medicine residency training program located in Vancouver, Wash. Clinic providers include 18 residents, 6 core physician faculty, 2 physician assistants, 1 psychologist, and 1 full-time equivalent clinical pharmacist organized as a single integrated partnership, and divided into two groups with 9 residents, 3 faculty, and 1 physician assistant in each. The clinic provides care to approximately 9,800 active patients with 30,000 visits per year. It serves a socioeconomically diverse population spanning all age-groups and provides maternity services. Most of the FMSW anticoagulation patients are from the Medicare population, which comprises 12% of the patient base and 32% of total visits.

All FMSW anticoagulation patients during the period between January 1997 and October 1997 were retrospectively selected from the laboratory test log. The log listed 114 patients by name, medical record number, laboratory test dates, and type of laboratory test performed. Because many patients were known to have received anticoagulation care at FMSW before and after these dates, the observation period for this study was arbitrarily set from 1 November 1996 through 31 October 1997.

After all study variables were extracted from the computer, data were compared with patient charts to assure all study patients met study inclusion criteria and to place patients in the correct study group. To be eligible for the study, patients must have received continuous anticoagulation care from FMSW providers. The minimum observation period for any patient was the time interval between at least two INR tests. This review process resulted in the deletion of 8 patients from the study and the finding of 10 crossover patients. For all 10 crossover patients, anticoagulation care provided by traditional care or anticoagulation clinic was continuous from their first to last observation date, and the crossover occurred just once (ie, traditional care to anticoagulation clinic or anticoagulation clinic to traditional care). Nine of the crossover patients were initially in the traditional care group. Including the 10 crossover patients in each group, the patient qualification process produced a final count of 41 in the anticoagulation clinic group and 75 in the traditional care group.

Table 1. Demographic Data of Patients in the Traditional Care (n = 75) and Anticoagulant Clinic (n = 41) Groups.

Demographic Characteristic	Traditional Care Group	Anticoagulation Clinic Group	*P* Value
Age, years (mean ± SD)	62.7 ± 15.5	64.2 ± 14.8	NS
Median	66.0	68.0	
Sex, % female	56	61	NS
Indication for anticoagulation, No (%)			NS
Atrial fibrillation	28 (37.3)	20 (48.8)	
Aortic or mitral valve replacement	9 (12.0)	5 (12.2)	
Cardiovascular disease	16 (21.3)	5 (12.2)	
Deep venous thrombosis	12 (16.0)	4 (9.8)	
Pulmonary edema	4 (5.3)	4 (9.8)	
Miscellaneous	6 (8.0)	3 (7.3)	
Days in study (mean ± SD)	197 ± 121.3	188.1 ± 122	NS
Median	190	176	
Patient years in study	40.58	21.12	

In addition to the patient qualification process, a manual chart review determined each patient's indication for anticoagulation. Based on treatment standards in effect during 1997 for each indication,[7] patients were categorized as having an optimum INR target range of 2.0–3.0 or 2.5–3.5.

The extracted inpatient admission and emergency department visit data were reviewed manually to assure that only hospital admissions and emergency department visits related to a bleeding or thromboembolic complication of anticoagulation were included in the study. This status was easily determined from the admitting diagnosis, procedure codes, and discharge diagnosis codes. When the data were unclear, emergency department visits or inpatient admissions were included or excluded based on chart review and consultation with an FMSW physician. If the emergency department visit or inpatient admission resulted in the initial prescribing of oral warfarin, the visit or admission was excluded from analysis.

INR test values were included in the study if the test was performed as an outpatient or emergency department test. Because the purpose of the study was to assess outpatient anticoagulation management, INR tests were excluded if they were performed as inpatient tests, as part of a preadmission workup, or as part of an excluded emergency department visit. After all INR tests had been screened for inclusion or exclusion, the elapsed time in days between tests was manually calculated for each patient. A treatment goal for the anticoagulation clinic was to obtain an INR test for each patient every 4 weeks, with the maximum allowable time between INR tests being 6 weeks.[4,6,8]

Statistical Analysis

The Mann-Whitney test was used to assess differences between continuous variables. Differences in rates and proportions were compared using the chi-square statistic. Adverse event rates were calculated as the number of events divided by the total number of patient-years in the study for each group and are expressed as events per patient-year of therapy. Differences in rates and 95% confidence intervals are reported. All statistical tests are two-sided and are considered statistically significant if *P* values are ≤ .05. Statistical analysis was done using Minitab (Minitab, Inc., State College, PA) and Stata (Stata Corp., College Station, Tex) statistical software packages.

Results

Demographics

There was no significant difference between the groups in terms of age, sex, and days in study (Table 1). The variable "indication for anticoagulation" was adjusted to collapse patients into meaningful groups of indications, and a miscellaneous category was used to group those with indications such as factor V deficiency and cardiomyopathy. Decisions for collapsing indications were made by physicians at FMSW. The percentage of valve replacement patients was 12.2% for the anticoagulation clinic group and 12.0% for the traditional care

Table 2. Anticoagulation Control of Traditional Care and Anticoagulant Groups.

International Normalized Ratio Data	Traditional Care Group	Anticoagulation Group	*P* Value
Number of tests	709	446	
Number of tests per patient year	17.47	21.12	
Highest ratio (median)	3.94	3.70	
Lowest ratio (median)	1.4	1.52	
Values normalized, No. (%)	20 (2.82)	3 (0.67)	
Percent in range	45.8	50.2	NS
Percent above range	19.6	16.8	NS
Percent below range	34.6	33	NS
Tests > ± 0.1 from target range, No. (%)	335 (47.2)	180 (40.3)	.022
Tests > ± 0.2 from target range, No. (%)	303 (42.7)	149 (33.4)	<.01
Tests > ± 0.5 from target range, No. (%)	193 (27.2)	69 (15.5)	<.01
Number of tests for 6-week variable	630	404	
Tests > 6 weeks apart, No. (%)	51 (8.1)	15 (3.7)	.01

group. There was no statistically significant difference found between the groups based on indication for anticoagulation.

Anticoagulation Control

The INR variable in the traditional care group had a range of 1.2 to 53. Patients cared for in the anticoagulation clinic had 21% more INR tests performed per patient year of therapy. Because INR values do not have interval scale properties (ie, a value of 16 is not twice as bad clinically as a value of 8), the INR values were normalized to values between 0.8 and 6.0. Values higher than 6.0 were changed to 6.0. There were no INR values lower than 0.8 in either group. INR value normalization resulted in 2.82% of traditional care group values and 0.67% of anticoagulation clinic group values being changed. Overall, 2.0% of the INR values were changed. (Table 2).

As shown in Table 2, analysis of total INR values within, above, and below the therapeutic range did not detect any statistically significant differences between the two groups. Compared with the anticoagulation clinic group, the INR tests in the traditional care group contained more values that were greater than ± 0.1, 0.2 and 0.5 respectively from the target range. Each of these differences was statistically different ($P = .022$, $P < .01$, $P < .01$ respectively). The anticoagulation clinic group also had a greater percentage of INRs performed at or before 6 weeks ($P = .01$) (Table 2).

Adverse Events Related to Bleeding or Thromboembolic Complications

The review of all emergency department visit and inpatient admission data found 1 inpatient admission and 2 emergency department visits that were related to complications of oral outpatient anticoagulation therapy in the anticoagulation clinic group compared with 8 inpatient admissions and 6 emergency department visits related to complications of outpatient therapy for the traditional care group. Analysis of adverse event rates did not detect a statistically significant difference in adverse events. (Table 3)

Table 3. Adverse Event Rates for Traditional Care and Anticoagulant Clinic Groups.

Adverse events	Traditional Care Group	Anticoagulant Clinic Group	Rate Difference 95% CI	*P* Value
Emergency department visits	6	2	0.053 (−0.12 to 0.23)	.63
Rate per patients year	0.148	0.095		
Rate per 100 patient years	14.8	9.5		
Inpatient admissions	8	1	0.15 (−0.02 to 0.32)	.15
Rate per patient year	0.197	0.047		
Rate per 100 patient years	19.7	4.7		

Table 4. Study Results Without 10 Crossover Patients.

Study Demographic	Traditional Care Group (n = 65)	Anticoagulant Clinic Group (n = 31)	*P* Value
Patient years in study	36.87	18.46	
INR in range, %	45.9	52.6	.04
INR above range, %	20.1	15.3	.06
Emergency department	4	2	
visits	0.1085	0.1083	>.99
Rate per patient year			
Inpatient admissions	6	1	
Rate per patient year	0.1627	0.0541	.32

Note: only comparisons that differed from the original results are presented.
INR = International normalized ratio.

Influence of the Crossover Patients

To address one potential threat to study validity, data for the 10 crossover patients were deleted and the analysis repeated. There were no significant differences for any of the four demographic variables compared, which is consistent with the results in Table 1. Comparison of anticoagulation control variables showed two differences from the results in Table 2. The INR in-range variable comparison achieved statistical significance, and the INR above-range variable comparison approached statistical significance in favor of the anticoagulation clinic group. Results from this second analysis that are not consistent with the original analysis are displayed in Table 4.

Discussion

The design of this study includes flaws typical of retrospective studies; however, this effectiveness study was conducted in a well-characterized family practice setting, which should make the results of interest to primary care clinics. Although the sample size was limited and study patients were not randomized into treatment groups, the study patients represent 100% of all anticoagulation patients attending the clinic between January and October 1997. Comparisons of age, sex, indication for anticoagulation, and study time did not find differences between the groups. A stronger study would have included additional demographic variables and variables for comorbidities, concomitant drug therapy, alcohol and tobacco use, compliance with drug therapy, and other risk factors that could have affected the clotting process and thus help explain the differences in outcomes between the two groups.

Once the anticoagulation patients were selected using the laboratory log review, pharmacists with a vested interest in the success of the anticoagulation clinic determined the inclusion or exclusion of study patients, INR tests, and related or unrelated hospital and emergency department events. Although inclusion and exclusion questions and decisions were reviewed with FMSW physicians, and the study investigators took every measure to preserve the integrity of the study, a potential conflict of interest situation existed.

The costs to operate the anticoagulation clinic were not analyzed. In a typical family practice clinic setting, implementation of an anticoagulation clinic model would require reassignment of existing staff to anticoagulation clinic duties or hiring a new pharmacist. It was assumed, but not known, that provider costs for anticoagulation clinic models were the same as or less than provider costs for traditional care models. As with costs, incremental clinic revenue differences generated by the anticoagulation clinic compared with traditional care patient management were not analyzed.

Study results suggest that the anticoagulation clinic group experienced better anticoagulation control than the traditional care group. Based on comparison of INR values outside target range, there was significantly more variation in INR test values within the traditional care group. The anticoagulation clinic was more consistent in obtaining an INR test at least every 6 weeks. This important result suggests that frequent and regular monitoring of anticoagulation control might be important in preventing adverse events. The measures of anticoagulation control suggest one mechanism to explain the clinically important differences in ad-

verse event rates between the groups. The anticoagulation clinic model was more rigorous in providing follow-up care for patients and in obtaining regular INR tests, which reduce the risk of adverse events. These results should be interpreted cautiously, because the statistical tests used for comparisons are based on the assumption of randomization of patients to treatment groups, which was not done in this study.

The study failed to show a statistical difference in adverse event rates. This lack of statistical significance could be because a difference did not exist, or because the study design was flawed, or because there was an insufficient sample size. It can be argued that the results do show a clinically significant difference in rates of adverse hospitalization events between the groups (4.7 for anticoagulation clinic vs 19.7 per 100 patient years for traditional care). For the differences in adverse event rates in this study to have reached statistical significance with a power of 80% and a type 1 error of 0.05, a patient sample size of approximately 88 patient years of therapy for each group (total of 176 patient years for the study) would have been required.[9]

Conclusions

This study showed that more anticoagulation patients cared for by the anticoagulation clinic model at FMSW received an INR test at least every 6 weeks than did those cared for by the traditional care model, and INR tests for the anticoagulation clinic group were more likely to be within the target range ± 0.1. The study found no statistically significant difference in adverse event rates between the groups. The results of this study suggest the need for future prospective studies of anticoagulation patient management to show that one treatment model can provide better outcomes at lower costs.

Stacy Aguas, RN, and Jan Awe, MS, from the Oregon Medical Professional Review Organization (OMPRO) provided consultation support on study design and methodology. Jan Awe, MS, performed statistical analysis of the data.

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