

# Empowering Patients to Monitor and Manage Oral Anticoagulation Therapy

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**O**RAL ANTICOAGULATION MANAGEMENT HAS UNDERGONE a number of improvements since the discovery and first clinical use of dicumarol in the early 1940s. In this issue of THE JOURNAL, Sawicki<sup>1</sup> describes a model of anticoagulation management that introduces the next phase in this evolution, a model of patient self-management made possible by point-of-care PT monitoring.

Since the introduction of point-of-care PT instruments more than 10 years ago,<sup>2</sup> a number of instruments have become available or are in development that determine a PT-INR measurement equivalent by activating capillary whole blood with tissue thromboplastin. The end point of clotting is determined by assessing the movement of blood cells or oscillating iron particles or by assessing the generation of thrombin by a fluorescent probe. Instruments are small, lightweight and portable, and studies have confirmed that patients can easily and accurately perform a fingerstick and obtain a PT-INR measurement from a sample of their own blood. Most importantly, the accuracy and precision of these instruments are comparable with results from standard plasma PT determinations.<sup>2-4</sup> The major limitations of these instruments include their tendency to underestimate high INRs and overestimate low INRs, the low thromboplastin sensitivity in some instruments and the inability to calculate a mean normal PT.<sup>4-8</sup>

Point-of-care PT monitoring has been available for professional use in the office or hospital setting for more than a decade. In the United States, 2 instruments have recently been approved for patient use at home (CoaguCheck and ProTIME Monitor). The actual management of oral anticoagulation in the home setting can be performed in 1 of 2 ways: (1) patients can measure their PT-INR and call in results to their physician for warfarin dose adjustment (patient self-testing) or (2) patients can be instructed in dose management and allowed to manage their own therapy within certain parameters (patient self-management) based on their own PT-INR measurement. Several studies have shown the value of patient self-testing. In a randomized controlled trial, White et al<sup>9</sup> showed that patient self-testing led to better therapeutic control than anticoagulation clinic testing in 23 patients who were treated for deep venous thrombosis over an 8-week period after hos-

pital discharge. In a 24-month nonrandomized observational study of 40 patients, Anderson et al<sup>10</sup> showed that patient self-testing yielded adequate therapeutic control and a high level of patient satisfaction. In a randomized controlled trial of 325 elderly patients with a variety of indications for anticoagulation, Byeth and Landefeld<sup>11</sup> showed a 52.5% reduction in major bleeding events in the first 6 months of therapy in the patient self-testing group.

Other studies have provided preliminary evidence for the value of patient self-management. My colleagues and I,<sup>12</sup> in a retrospective case-controlled study of 20 patients who managed their own therapy over a 7-year span, demonstrated better therapeutic control and fewer dose changes in the self-managed group compared with matched controls managed by an anticoagulation clinic. In an uncontrolled observational study, Bernardo<sup>13</sup> demonstrated a similar benefit. In a study of 150 patients with prosthetic heart valves randomized between patient self-management (n = 75) and physician management (n = 75), Horstkotte et al<sup>14</sup> reported better therapeutic control and less bleeding in the patient self-management group. An ongoing German study (Early Self-Controlled Anticoagulation Trial) is assessing this same question in a much larger cohort of approximately 1200 patients randomized to either patient self-management or physician management.

In this issue of JAMA, Sawicki<sup>1</sup> presents additional evidence from a randomized study of the potential value of patient self-management following a structured educational process. Patients were prospectively randomized to patient self-management (n = 90) or usual care, consisting of management by their personal physician (n = 89). After a structured teaching process that took approximately 3 to 5 hours per patient, the investigators assessed the quality of anticoagulation (cross-section of the files method) by comparing the distribution of INRs from the midpoint of each patient's therapeutic range at 3 months and 6 months. Patients in the self-management group were significantly closer to their target INR, had a greater percentage of values within therapeutic range, and reported greater satisfaction with this management approach, compared with patients in the usual care group. This study leads the way to an

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**Financial Disclosure:** Dr Ansell has been a consultant to Roche Diagnostics, Avocet, and International Technidyne.

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See also p 145.

entirely new model of care that has great potential, even though a number of questions remain that leave the results open to interpretation and suggest the need for better-designed trials.

To assess its true benefits, patient self-testing or patient self-management should be compared with the "gold standard" of existing care. For oral anticoagulation, that standard is a coordinated approach that is provided by an anticoagulation clinic.<sup>15,16</sup> Such focused oversight has been shown to provide better therapeutic control and a 50% to 75% reduction in major bleeding events<sup>17</sup> compared with usual care. However, while this care should be the reference standard in the United States, it is not readily available in Germany.

It is not clear from the design of the study in this issue what accounted for the improved therapeutic control. Differences in the frequency of testing between the 2 groups might have been responsible since the patients in the self-management group measured their INR 4 to 8 times per month compared with 2 times per month for patients in the control group. Such frequent monitoring may not be feasible without patient self-testing. In this study the value of testing 1 to 2 times per week and making dose adjustments also can be questioned given the long half-life of the anticoagulant in use (phenprocoumon, which has a half-life of approximately 5 days). Patient education was distinctly different between the 2 groups. The more thorough and intense education that was provided to the study group could have led to enhanced compliance that might have been partly responsible for the observed differences in outcome.<sup>18</sup> This study was performed in patients with prosthetic heart valves or atrial fibrillation, many of whom had been taking oral anticoagulants for months to years. It does not fully assess the impact of this approach for patients just starting therapy when the risk of bleeding is greatest.<sup>19,20</sup> Because of these many variables, this study cannot determine the principal question raised by the authors of whether the improved outcome was a result of the educational program and better management decisions by the patients.

There are several possible reasons that patient self-management might result in better therapeutic control or outcomes compared with usual care or even anticoagulation clinic care. Testing at home allows not only for an increased frequency of testing, but also improved timeliness, providing the ability to test when it is needed. The use of the same instrument should provide a degree of consistency not always obtained by patients who might otherwise be tested in different laboratories from time to time. Patient self-testing might allow better management of patients who need to stop taking anticoagulants for invasive procedures. Finally, patient self-management may have a subtle impact on patient empowerment, compliance, and satisfaction that may be important elements in achieving better outcomes.

The labor intensiveness of managing oral anticoagulation and the fear of adverse events have been shown to discourage physicians from treating patients with atrial fibrillation who are candidates for anticoagulation therapy.<sup>16,21</sup> If patient self-management reduces the frequency of adverse events or simply facilitates treatment, it may lead to an increase in the prescribing of oral anticoagulants by physicians who previously

were reluctant to use these agents. For instance, the cost benefit of treating more patients who have atrial fibrillation with oral anticoagulation has been shown by Matchar and Samsa,<sup>16</sup> who estimate a cost savings of approximately \$1900 per newly anticoagulated patient. Models of care that place more responsibility in the hands of patients undoubtedly will continue to increase. Patient self-management of oral anticoagulation has great potential, but future studies must compare this approach with the current gold standard of management in terms of therapeutic control or adverse events, must address the issue of the optimal frequency of testing and whether such frequency is achievable outside of patient self-testing, and must clearly identify the long-term cost-effectiveness of such therapy.

#### REFERENCES

1. Sawicki PT, for the Working Group for the Study of Patient Self-Management of Oral Anticoagulation. A structured teaching and self-management program for patients receiving oral anticoagulation: a randomized controlled trial. *JAMA*. 1999; 281:145-150.
2. Lucas FV, Duncan A, Jay R, et al. A novel whole blood capillary technique for measuring prothrombin time. *Am J Clin Pathol*. 1987;88:442-446.
3. Leaning KE, Ansell JE. Advances in the monitoring of oral anticoagulation: point-of-care testing, patient self-monitoring, and patient self-management. *J Thromb Thrombolysis*. 1996;3:377-383.
4. McCurdy SA, White RH. Accuracy and precision of a portable anticoagulation monitor in a clinical setting. *Arch Intern Med*. 1992;152:589-592.
5. Jennings I, Luddington RJ, Baglin T. Evaluation of the Ciba Corning Biotrack 512 coagulation monitor for the control of oral anticoagulation. *J Clin Pathol*. 1991; 44:950-953.
6. Tripodi A, Arbini AA, Chantarangkul V, et al. Are capillary whole blood coagulation monitors suitable for the control of oral anticoagulant treatment by the international normalized ratio? *Thromb Haemost*. 1993;70:921-924.
7. Tripodi A, Chantarangkul V, Clerici M, Negri B, Mannucci PM. Determination of the international sensitivity index of a new near-patient testing device to monitor oral anticoagulant therapy. *Thromb Haemost*. 1997;78:855-858.
8. Kaatz AA, White RH, Hill J, et al. Accuracy of laboratory and portable monitor international normalized ratio determinations. *Arch Intern Med*. 1995;155:1861-1867.
9. White RH, McCurdy SA, von Marenzendorff H, Woodruff DE, Leftgoff L. Home prothrombin time monitoring after initiation of warfarin therapy. *Ann Intern Med*. 1989;111:730-737.
10. Anderson D, Harrison L, Hirsh J. Evaluation of a portable prothrombin time monitor for home use by patients who require long-term oral anticoagulant therapy. *Arch Intern Med*. 1993;153:1441-1447.
11. Byeth RJ, Landefeld CS. Prevention of major bleeding in older patients treated with warfarin: results of a randomized trial [abstract]. *J Gen Intern Med*. 1997;12:66.
12. Ansell J, Patel N, Ostrovsky D, Nozzolillo E, Peterson AM, Fish L. Long-term patient self-management of oral anticoagulation. *Arch Intern Med*. 1995;155: 2185-2189.
13. Bernardo A. Experience with patient self-management of oral anticoagulation. *J Thromb Thrombolysis*. 1996;2:321-325.
14. Horstkotte D, Piper C, Wiemer M, Schulte HD, Schultheiss H-P. Improvement of prognosis by home prothrombin estimation in patients with life-long anticoagulant therapy. *Eur Heart J*. 1996;17(suppl):230.
15. Hirsh J, Dalen JE, Anderson DR, et al. Oral anticoagulants: mechanism of action, clinical effectiveness, and optimal therapeutic range. *Chest*. 1998;114(suppl): 445S-469S.
16. Matchar DB, Samsa GP. Should we just let the anticoagulation service do it? *J Gen Intern Med*. 1996;11:768-770.
17. Ansell JE. Anticoagulation management as a risk factor for adverse events: grounds for improvement. *J Thromb Thrombolysis*. 1998;5(suppl):S13-S18.
18. Mullen PD, Simons-Morton DG, Ramirez G, et al. A meta-analysis of trials evaluating patient education and counseling for three groups of preventive health behaviors. *Patient Education Counseling*. 1997;32:157-173.
19. Petitti DB, Strom BL, Melmon KL. Duration of warfarin anticoagulant therapy and the probabilities of recurrent thromboembolism and hemorrhage. *Am J Med*. 1986;81:255-259.
20. Beyth RJ, Landefeld CS. Outcomes of warfarin therapy: lessons from the real world. *Mayo Clin Proc*. 1995;70:806-808.
21. Kutner M, Nixon G, Silverstone F. Physicians' attitudes toward oral anticoagulants and antiplatelet agents for stroke prevention in elderly patients with atrial fibrillation. *Arch Intern Med*. 1991;151:1950-1953.