Reimagining Anticoagulation Clinics in the Era of Direct Oral Anticoagulants

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Abstract—Anticoagulation clinics were initially developed to provide safe and effective care for warfarin-treated patients with atrial fibrillation, venous thromboembolism, and mechanical valve replacement. Traditionally, these patients required ongoing laboratory monitoring and warfarin dose adjustment by expert providers. With the introduction of direct oral anticoagulants (dabigatran, rivaroxaban, apixaban, and edoxaban), many have questioned the need for anticoagulation clinic. However, we think that the growing number of oral anticoagulant choices creates an urgent need for expanding the traditional role of the anticoagulation clinic. We outline 3 key purposes that a reimagined anticoagulation clinic would serve: (1) to assist patients and clinicians with selecting the most appropriate drug and dose from a growing list of anticoagulant options (including warfarin), (2) to help patients minimize the risk of serious bleeding complications with careful long-term monitoring and peri-procedural management, and (3) to encourage ongoing adherence to these life-saving medications. We also describe how repurposing anticoagulation clinics as broader medication safety clinics would promote safe and effective care across a range of cardiovascular conditions for high-risk medications (eg, spironolactone, amiodarone). Finally, we highlight a few existing health systems that are overcoming key challenges to implementing a reimagined anticoagulation or medication safety clinic structure. (Circ Cardiovasc Qual Outcomes. 2016;9:182-185. DOI: 10.1161/CIRCOUTCOMES.115.002366.)

Key Words: anticoagulant ■ anticoagulation ■ nurse management ■ pharmacist management ■ warfarin

Millions of Americans take warfarin daily for atrial fibrillation or venous thromboembolism. Although highly effective for preventing thromboembolic complications, use of warfarin can also cause life-threatening bleeding. Individual variability around warfarin metabolism requires careful dose titration and patient education about diet–drug and drug–drug interactions to minimize such complications. To address these challenges, anticoagulation clinics were developed as a multidisciplinary means to mitigate the risk of bleeding while ensuring safe and effective care for patients taking warfarin. In the United States, over 3000 multidisciplinary anticoagulation clinics currently monitor INR laboratory tests for millions of Americans treated with warfarin, reducing emergency department visits, hospitalizations, and thromboembolic complications. Their primary function is to provide a safety net for patients taking anticoagulant drugs with critical safety profiles.

Since 2009, 4 new direct oral anticoagulants (DOACs) have been introduced as potential replacements for warfarin, and the use of these agents is growing quickly.2,3 Given that the metabolism of these medicines does not vary individually, and they therefore do not require INR laboratory testing or frequent dose adjustments, frequent monitoring is perceived to be unnecessary. Much of the marketing around these drugs has emphasized this advantage. This can be equated with diminished need for specialized anticoagulation clinics. However, rather than diminish the importance of anticoagulation clinics, we think the growing number of DOACs creates an urgent need for expanding the traditional role of the anticoagulation clinic. A reimagined anticoagulation clinic would serve 3 key purposes for every patient on anticoagulant medications: (1) to assist patients and clinicians with selecting the most appropriate drug and dose from a growing list of anticoagulant options (including warfarin), (2) to help patients minimize the risk of serious bleeding complications with careful long-term monitoring and peri-procedural management, and (3) to encourage ongoing adherence to these life-saving medications.

When anticoagulants are first initiated, anticoagulation clinics should serve as an informational resource and decision support service. Specifically, patients and providers need detailed information about each available anticoagulant to determine which is most appropriate. Patients and providers will benefit from the expertise of the specialized pharmacists and nurses who assist with appropriate drug selection and dosing given comorbid renal or liver impairment and concurrent...
medication use. Although the DOACs have far fewer drug–
drug interactions than warfarin, there are still some medicines
that require DOAC dose reduction or avoidance. Leveraging
an anticoagulation clinic pharmacist’s expertise will help
patients and providers prevent and manage these important
potential interactions. The anticoagulation clinic staff can
also review the cost implications of various anticoagulants for
patient out-of-pocket expenses given their prescription drug
and insurance coverage. These providers can also spend more
time with patients than most primary care or specialty physi-
cians. After the initial medication is selected, anticoagulation
clinics will periodically evaluate and follow up, answering any
patient questions or concerns. This ongoing relationship likely
improves DOAC adherence, an essential component of safe
and effective anticoagulant care. Expanding the anticoagu-
lation clinic’s ability to assist in medication selection, patient
education, and encouraging adherence will benefit patients
and providers alike.

A second key purpose of the reimagined anticoagulation
clinic is to reduce harm from bleeding related to an inappro-
priate dose. For warfarin-treated patients, this is done through
INR laboratory draws and warfarin dose adjustments. In
DOAC-treated patients, dosing is directly linked to a patient’s
renal function, as well as the indication. Although most
providers know to check renal function when initially prescribing
DOAC therapy, ongoing monitoring of renal function is often
overlooked. Over 20% of atrial fibrillation patients develop
renal dysfunction, with DOAC dosing implications. This
 can lead to life-threatening bleeding complications when the
DOAC dose is not adjusted for declining renal function. The
anticoagulation clinic is a resource already in place to monitor
these patients and make necessary dosing adjustments.

A reimagined anticoagulation clinic would also reduce
harm from bleeding in the peri-procedural period. Each year,
over 500,000 atrial fibrillation patients undergo procedures
that require interruption of their anticoagulation therapy. Anticoagulation clinic providers have specialized expertise
that should be leveraged to help all anticoagulated patients
avoid complications when procedures are indicated. The
time needed to stop an anticoagulant before and after a procedure
varies greatly depending on the medication, a patient’s renal
function, and the bleeding risk of the proposed procedure. A
centralized model where all peri-procedural anticoagulation
decisions are managed by the anticoagulation clinic nurses
and pharmacists will allow for standardized, evidence-based
care that can rapidly incorporate and implement new clinical
evidence. It also gives patients and providers a clear go-to team
for answers and coordination, instead of relying on the patient
to coordinate opinions from multiple providers, potentially
from different health systems. Importantly, it will remove that
burden from primary care providers, cardiologists, procedural-
lists, and surgeons.

A third key purpose of the reimagined anticoagulation
clinic is to encourage long-term medication adherence. A
medicine is of no benefit (and potential harm) when not taken
regularly. This is especially important for DOAC-treated
patients, for whom skipping 1 to 2 doses may leave them
unprotected from a deadly stroke or pulmonary embolism.
Clinic visits were scheduled at least every 3 months in the
major trials comparing warfarin to DOACs and have been
recommended every 3 to 6 months by the European Heart
Rhythm Association. Continual contact with the health sys-
tem is an important reminder to take medications and an
opportunity to address any challenges patients might be fac-
ing. A recent Veterans Affairs study demonstrated that long-
term monitoring of dabigatran treatment (one of the DOAC
medications) by an anticoagulation clinic with support from
pharmacists was associated with the highest likelihood for
medication adherence. The Veterans Affairs model has inspired other models, including the University of Michigan
Anticoagulation Clinic, to perform several roles related
to consultation for drug and dose selection, monitoring for
changes in renal function and medication adherence, and
identification of lowest-risk patients for whom anticoagulant
therapy is not indicated. Anticoagulation clinic support and
consultation should be used to ensure safe, high-quality anti-
coagulation care.

Despite these examples and opportunities, barriers exist to
widespread adoption of a reimagined anticoagulation clinic.
The greatest challenge is financing. With increasing utiliza-
tion of DOACs, health systems and insurers may be tempted
to discourage use of anticoagulation clinics and avoid pay-
ning for these services. This is especially true because exist-


ing studies of cost-effectiveness for DOAC medications
did not include the costs of anticoagulation clinic support.
Additionally, it may require a change in culture and habitual
practice patterns, to encourage providers to consult the anti-
coagulation clinic early for assistance with drug selection
and dosing, and throughout the patient’s care, to standardize
peri-procedural anticoagulation, and to establish and oversee
a renal function monitoring plan in DOAC-treated patients.
Finally, institutional policies may need to be updated to
empower specialist nurses and pharmacists to manage these
specific clinical scenarios. Expanding both the role and the
availability of anticoagulation clinics, which may not be uni-
versally available for all patients, should be a top priority for
patient-centered care.

A potentially significant driver for reimaging anticoagu-
lant care is the changing healthcare payment landscape. New
payment models encourage healthcare organizations to focus
on holistic strategies that improve care and reduce expenses.
For instance, accountable care organizations are responsible
for total costs of care, not just fee-for-service costs. Therefore,
embracing strategies to reduce adverse drug events are likely
to be financially beneficial and act as a key facilitator for such
system redesign.

To that end, instead of reimaging the anticoagulation
clinic to serve a broader need for anticoagulated patients, a
more logical approach may be for current anticoagulation clin-
ics to evolve into medication safety clinics. These repurposed
clinics would play a valuable role promoting safe and effec-
tive care across a broader range of cardiovascular conditions
for high-risk medications. Specific to anticoagulation care,
the clinics might ensure that patients with acute deep venous
thrombosis have rapid follow-up after an emergency depart-
ment (or primary care) visit to review and assess anticoagulant
therapy compliance. Avoiding costly emergency department
visits and hospital admissions likely also improves patient
satisfaction.\textsuperscript{10} They would also play a more central role in the management of perioperative anticoagulation management, determining when bridging anticoagulation is necessary and educating patients on safe bridging anticoagulant administration. Given that bridging anticoagulants are frequently overused, reductions in the use of outpatient low molecular weight heparin or inpatient unfractionated heparin should lead to significant savings.\textsuperscript{7,11}

Beyond the care of patients taking anticoagulants, a medication safety clinic could also provide valuable support in many settings: for patients taking mineralocorticoid receptor antagonists (e.g. spironolactone) for hypertension or heart failure; for patients taking amiodarone for arrhythmia control; and for patients taking other cardiovascular medications that require long-term monitoring and dose adjustment. Recent studies have shown that only 7.2\% of patients initiated on a mineralocorticoid receptor antagonist receive appropriate potassium and renal function monitoring in the initial 90 days.\textsuperscript{12} Widespread use of spironolactone after publication of the Randomized Aldactone Evaluation Study (RALES) trial was associated with marked increases in hospital admissions and in-hospital death from hyperkalemia.\textsuperscript{13} Similarly, only half of patients prescribed amiodarone receive the recommended liver and thyroid function screening that is advised.\textsuperscript{14} In at least one case, a pharmacist-led medication clinic was able to significantly improve the rate of liver, thyroid, and pulmonary function screening for amiodarone patients in a cost-saving manner.\textsuperscript{15} A medication safety clinic would leverage the existing anticoagulation clinic infrastructure of nurse and pharmacist experts designed for longitudinal medication monitoring to reduce complications from a variety of effective, yet potentially dangerous, cardiovascular medications. In this manner, the business justification supporting a medication safety clinic would be even greater than that of a more narrowly focused anticoagulation clinic.

Although these approaches make logical sense, robust data are lacking. In addition to the retrospective study reporting medication adherence from the Veterans Affairs system, prospective data (preferably randomized or cluster-randomized) assessing patient outcomes will be important.\textsuperscript{5} Similarly, rigorous assessment of medication safety clinic function and the costs associated with avoided complications will be needed to strengthen the business case. In the meantime, experimenting with different clinic designs will lead to innovative new approaches focused on improving patient safety. Similarly, clinicians may find themselves relying on medication safety clinics to routinely manage and monitor their patients at highest risk for complications. This approach will ensure high-quality, patient-centered care for DOACs, warfarin, and other common cardiovascular medications. Already, Blue Cross–Blue Shield of Michigan has invested in a multicenter collaboration (the Michigan Anticoagulation Quality Improvement Initiative) to measure anticoagulant care delivery and implement new approaches aimed at safe and efficient management of high-risk therapy.

Acknowledgments

No financial support was provided for this work. The article was conceived and written by Dr Barnes with critical review and revisions by Drs Nallamothu, Sales and Froehlich.

Sources of Funding

Dr Barnes is supported on the National Heart, Lung, and Blood Institute grant 2-T32-HL007853-16.

Disclosures

Dr Barnes discloses research funding from BMS/Pfizer and Blue Cross Blue Shield of Michigan. Dr Barnes has served as a consultant for Portola. Dr Nallamothu discloses research funding from National Institutes of Health and the Veterans Affairs (VA) Health Services Research & Development. Dr Sales discloses finding from the VA Health Services Research and Development Service and VA QUERI Program. Dr Nallamothu serves as a member for the UnitedHealthcare Cardiac Scientific Advisory Board. Dr Froehlich discloses research funding from BMS/Pfizer, the Fibromuscular Disease Society of American, and Blue Cross Blue Shield of Michigan. Dr Froehlich has served as a consultant to Pfizer, Merck, Boehringer-Ingelheim, Janssen, and Novartis.

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Circ Cardiovasc Qual Outcomes. 2016;9:182-185; originally published online March 1, 2016; doi: 10.1161/CIRCOUTCOMES.115.002366
Circulation: Cardiovascular Quality and Outcomes is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
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Print ISSN: 1941-7705. Online ISSN: 1941-7713

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