Implementing anticoagulation management by pharmacists in the inpatient setting

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Since the availability of warfarin and heparin over 50 years ago for the management and prevention of thromboembolism, the understanding of dosing approaches and monitoring of anticoagulant therapy has continued to evolve. Recent expansions in available anticoagulant therapies, and additional information regarding their optimal use, have created more choices and management considerations when developing a treatment plan for anticoagulation therapy. To address this, health care systems and physicians increasingly recognize the potential benefits of pharmacist involvement in the management of anticoagulant therapy.

The concept of pharmacists managing anticoagulation therapy is not new. Ambulatory care pharmacist’s have performed this function for years, with more recent reports supporting pharmacists’ involvement inside of the hospital. The purpose of this article is to explore approaches for successful implementation of an inpatient anticoagulation program involving pharmacists.

Two successful inpatient anticoagulation programs previously reported in the literature are described with a discussion of steps to consider in developing or expanding such a service.

Purpose. This article identifies approaches for implementing an inpatient anticoagulation program involving pharmacists; two successful inpatient anticoagulation programs previously reported in the literature are described with a discussion of steps to consider in developing or expanding such a service.

Summary. Two institutions implemented pharmacist-managed anticoagulation services. One institution identified an undesirable incidence of medication-related adverse events occurring in hospitalized patients receiving anticoagulants. Pharmacists were asked to assist. Pharmacist activities included the selection of anticoagulants, patient education, verification of insurance coverage of the patient’s anticoagulant, and coordination of follow-up. Physicians were available to assist. At the other institution, the department of pharmacy was asked by the orthopedic surgeons to manage warfarin for the prophylaxis against venous thromboembolism. The pharmacy department worked with the medical staff to gain approval of all policies, guidelines, and protocols to establish an anticoagulation service.

Because of the success of the program, the pharmacy department expanded the service beyond warfarin. The steps to establishment of an anticoagulation service are described. The challenges facing such programs are discussed, including the potential anticoagulants in development that will create ongoing challenges in deciding which anticoagulation approach to use and in identifying patients for whom the newer agents may or may not be best suited.

Conclusion. Requirements for establishing a successful inpatient anticoagulation management program included defining the pharmacist’s role in identifying patient needs, gaining support from other health care professionals, designing a program that addresses the needs of the patients, and managing unanticipated issues.

Index terms: Administration; Anticoagulants; Drugs; Health-benefit programs; Interventions; Patient information; Pharmaceutical services; Pharmacists, hospital; Pharmacy, institutional, hospital; Protocols; Thromboembolism; Toxicity; Warfarin

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Anticoagulation services at the University of California Davis Medical Center

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Davis Medical Center (UCDMC), an outpatient anticoagulation clinic was established in 1985. In 1992, a review of medication-related misadventures and queries from prescribing physicians identified an undesirable incidence of medication-related adverse events occurring in hospitalized patients receiving anticoagulants. At the request of the medical staff, pharmacists were asked to provide assistance in managing anticoagulants. Because of the acceptance of pharmacist input on management considerations by the medical staff over time and the realization that new information, change in policies, and the availability of newer assay methods were rapidly incorporated into patient management, the service provided was more accurately described as an antithrombosis service rather than a service specifically created for anticoagulation therapy. Pharmacists’ activities included facilitating the selection of anticoagulants to be used according to policies set by the pharmacy and therapeutics (P&T) committee. This included initiating treatment and follow-up monitoring for warfarin and, in some situations, unfractionated heparin (UFH). The service expanded to include managing heparin-induced thrombocytopenia (HIT); evaluating requests for low-molecular-weight heparin (LMWH), fondaparinux, recombinant factor VIIa, or vitamin K reversal; and facilitating selected ongoing investigational trials. In addition, pharmacists facilitated care plans for patients’ transition to the outpatient setting. This included patient education, verification of insurance coverage of the selected anticoagulant, coordination of follow-up care with concurrent overlapping therapies (i.e., bridging), and arranging close follow-up when necessary.19

To make the service proactive and accessible to the medical staff within the entire health system, a dedicated phone number (XXX-CLOT) was established and advertised. A group of physician champions were typically available to assist in questions of diagnosis, concerns from their peers, and unique management approaches. Using the pharmacy information system, a standard order, “warfpt,” was developed for patients with orders for warfarin to tag any new drug interactions and provide a daily search of all patients identified as receiving warfarin, irrespective of whether a dose had recently been given. Additional tags were developed to document completion of education (“warfptd”), requests for warfarin dosage by pharmacy (“acpt”), and others that identified patients enrolled in various research projects. Developing an initial weight-based regimen for UFH infusions and home treatment with subcutaneously administered UFH were additional responsibilities. This led to pharmacy involvement in using LMWHs and the newer agent fondaparinux as well as in the compassionate use of danaparoid for HIT before the availability of direct thrombin inhibitors (DTIs).

As newer anticoagulants became available, which created multiple choices for management, pharmacists were recognized as a centralized resource to maintain their safe use under guidelines set forth by the P&T committee. In addition to challenges in managing unique patient populations (e.g., obesity, pregnancy, renal failure), physicians frequently asked for advice in difficult situations (e.g., concurrent pulmonary embolism and intracranial bleeding, critical International Normalized Ratio [INR] values). A working relationship with the clinical laboratory created the ability to incorporate the limitations of a given laboratory assay or results for a particular antithrombotic botic regimen. An additional benefit of this relationship was the ability to promptly adjust target ranges for anticoagulation management protocols when notable changes in reagent sensitivity or specificity occurred.

To address the constant changes in anticoagulation therapy, a thrombosis subcommittee of the P&T committee was established to allow increased expertise and input from multiple medical disciplines including various medical specialties, but also laboratory medicine, as a collaborative means to improve patient care in either the inpatient or outpatient setting. This included not only management of anticoagulation therapy but reversal therapies, agents for hemostasis (primarily recombinant factor VIIa), continuity of care from the inpatient to the outpatient setting, and screening mechanisms such as probability assessments for HIT. Each request received from pharmacy operations or the prescribing clinician for a LMWH, factor Xa inhibitor, DTI, vitamin K, recombinant factor VIIa, and warfarin was reviewed before dispensing. Some agents may have a first dose dispensed during the night shift after selected key baseline laboratory values (INR, activated partial thromboplastin time [aPTT], complete blood count [CBC], liver and kidney functions, patient’s age and weight) or indication for use was reviewed. These functions allowed for continued screening for presence of patient factors (e.g., epidural catheters, measurement of baseline coagulation studies) or identification of unique dosing populations (e.g., compromised renal function) to be incorporated into the management plan. Before dispensing, requests for recombinant factor VIIa were immediately screened by the specialty pharmacist on call to assess if preestablished criteria established by the P&T committee had been met.

**Anticoagulation services at St. Mary’s Medical Center**

In 2003, the department of pharmacy at St. Mary’s Medical Center (SMMC) in Duluth, Minnesota, was asked by the orthopedic surgeons to manage warfarin for their patients for the prophylaxis against venous
thromboembolism (VTE). A newly hired clinical coordinator was tasked to launch the service. While this new coordinator had experience in the dosing and management of anticoagulants in both inpatient and outpatient settings, implementing an anticoagulation service was a new experience. Key literature applied to implementation included the report on the positive effect that inpatient pharmacists can have on managing warfarin and a report supporting the feasibility of applying the concept to an orthopedic surgery population without causing excessive bleeding.

During the same time period, the health system had become aware of serious medication misadventures due to warfarin in both inpatient and outpatient settings. To rectify this situation, the following were emergently implemented in the inpatient setting:

- Warfarin orders for longer than 24 hours were no longer accepted in the acute care setting.
- Daily INR monitoring was mandated for all inpatients on warfarin.
- Pharmacy was asked to fast track the implementation of pharmacist-managed warfarin dosing and was asked by hospital administration to make this service available to all patients, not just orthopedics.
- All patients who were prescribed warfarin, or would be prescribed warfarin, would have a generic warfarin standing order placed in the computer to prompt the nurse to look for the current day’s warfarin dosage and to assure computer screening for drug interactions.

The warfarin anticoagulation service was made available throughout SMMC in November 2003, which was within one month of the above emergent actions. The pharmacy department worked very closely with the medical staff to gain approval of all policies, guidelines, and protocols needed to implement the anticoagulation service. Two physicians with extensive experience in anticoagulation matters offered to serve as champions for the program, providing additional support for both pharmacists and physicians. The P&T committee approved all policies and procedures.

The SMMC anticoagulation service is a consultation-based service where physicians can consult pharmacy for managing warfarin therapy. The program is run on a day-to-day basis by the decentralized clinical pharmacists and is overseen by the clinical pharmacy specialist (former title was clinical coordinator), who coordinated the program’s implementation. Clinical specialists and pharmacy practice residents run the program on weekends and holidays. The program has been strongly supported and recommended for use by hospital administration and medical staff executives. Since the implementation of the program, the hospital has had no serious medication misadventures involving warfarin for any of the pharmacist-managed patients.

Because of the success of the program, the pharmacy department expanded the service beyond warfarin dosing to include other areas of anticoagulation management. First, the department developed anticoagulation bridging guidelines to be used throughout the system based largely on the literature and the Chest guidelines. As part of this program, the pharmacists closely monitor all of their warfarin inpatients to assure that they are bridged appropriately when indicated. While most anticoagulation bridging occurs in the outpatient setting, our pharmacists ensure that inpatients who have subtherapeutic INRs receive heparin or LMWH therapy when appropriate. Second, the pharmacists began to dose and monitor the use of argatroban for HIT. This was followed by updating the pharmacy vitamin K reversal policies so their use was consistent with current recommendations. The department also standardized guidelines for the use of enoxaparin across the system. The pharmacists used these guidelines when asked by the medical staff to dose LMWHs and monitor prescribed doses for compliance. Currently, the department is attempting to standardize the use of recombinant factor VIIa and is in the final stages of implementing a required standing order to be used whenever the medication is needed. While this work has been more administrative in nature, the use of recombinant factor VIIa forms will ensure the dispensing pharmacist that the use and dosage are appropriate in what is usually an emergent situation.

To help ensure the continued success of the anticoagulation program and to continue to expand the efforts in promoting the safe use of anticoagulants, the health system created an expert group of nurses, pharmacists, and physicians to oversee improvement of anticoagulation care in both inpatient and outpatient settings. The pharmacist who led the implementation of the inpatient service is the chair of this group. The group reports its activities to medical staff quality committees and to the P&T committee. This group regularly reviews indicators of quality for both inpatient and outpatient anticoagulation programs and continues to work on practice improvement. This group has been critical in securing continued confidence from the medical staff that the pharmacy department is providing the highest level of care with the anticoagulants they monitor in the hospital.

Establishing an anticoagulation service

Review the literature. A recommended first step in setting up a program of this nature is to review the available literature. Published observations from individual institutions evaluating pharmacists’
involvement in managing inpatient anticoagulation indicate consistent evidence of improved clinical outcomes while reducing the cost of therapy (Table 1).\textsuperscript{2,11,16}

In a recent report by Bond and Raehl,\textsuperscript{7} the potential effect of pharmacist involvement in managing either UFH or warfarin was analyzed and the results provided additional evidence supporting the observations of the reports in Table 1. Hospitals with pharmacists providing management of either warfarin or heparin were observed to have significantly ($p < 0.001$) lower anticoagulation-related mortality, length of hospital stay, bleeding complications, blood transfusion requirements, and cost of therapy. Noting that anticoagulants, such as heparin and enoxaparin, are commonly used in hospitals that have been frequently associated with harmful prescribing errors, the authors concluded that “pharmacy directors and clinical coordinators should develop pharmacist-provided anticoagulation management as an integral component of their core service mix.”

**Gain support for the proposed program.** The successful implementation of an inpatient anticoagulation service requires support from the entire pharmacy department, medical staff, hospital (health-system) administration, and nursing administration, with key individuals identified to champion the concept. Initial groundwork should consider a multidisciplinary, team-building approach to assist in developing a successful program. A program manager should be chosen and physician champions identified. All necessary policies and procedures and the potential scope of the program should be reviewed and approved by the P&T committee. Defining the initial focus will depend on the perceived initial and long-term needs and will likely vary among institutions.

To start the service, evaluate the institution’s patient demographics, the type of institution (e.g., community, academic), problems that have been encountered with patient care (e.g., adverse events, confusing treatment plans), physician support, and how anticoagulants are used and controlled. Target the service toward patients with the greatest need, and develop a plan on how you will demonstrate the value of the service to hospital administration. For example, can your service or patient care activities demonstrate a decrease in the number of adverse drug events due to anticoagulants? Examples of measurable surrogate markers of therapy outcomes successfully used have been previously reported.\textsuperscript{6}

Before establishing the program, it is also important that others in the pharmacy are supportive of the program, with potential logistical challenges identified. Pharmacist managers or designated providers should consider shadowing the process at a similar hospital with a successful program while refining any required skills and expanding their knowledge of the literature. They should consider using professional organizations to expand their understanding of other established programs and review their procedures. Finally, they should ensure that pharmacists selected to staff the program have the necessary knowledge, skills, and confidence to improve patient care. This can be achieved through a formal competency program that assesses both baseline knowledge of anticoagulation and thromboembolism and the ability to apply the concepts in practice.

Development of support structures to maximize the clinical efficiency of pharmacists should be considered. This may include dosing tools, generation of workload lists for specified target drugs, specific patient diagnosis groups, preidentified laboratory values, and electronic tracking systems that can generate activity reports.\textsuperscript{18-30} Although such dosing tools can provide some degree of improved patient care over preexisting approaches, there are many patient variables that cannot be incorporated into the assessment. In contrast, a trained pharmacist can take changing clinical presentations into consideration.\textsuperscript{25,31}

The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) is taking an increasingly active role in promoting direct pharmacist involvement in the care of patients receiving anticoagulation therapy. This is in part driven by the observation that anticoagulants are associated with a high incidence of adverse medication events causing harm and admission to the emergency room.\textsuperscript{32-35} Early drafts of the 2007 National Patient Safety Goals called for a pharmacist who “is involved in in-patient anticoagulation services for both heparin and warfarin to provide input on dosing and monitoring of patients on anticoagulation therapy.”\textsuperscript{36} Furthermore, JCAHO has drafted core measures aimed at systematizing and improving the quality of prevention and treatment of VTE.\textsuperscript{37} The proposed core measures do much more than simply ensure that VTE is being prevented; they also call for systematic and correct use of heparin products and warfarin. Some core measures may be implemented as early as 2007, with others following in subsequent years after initial field-testing. Health systems may need to take a closer look at their current approach in prophylaxis and management of VTE patients and develop strategies on how to meet the final developed standards. If portions of the above two measures are enacted, it will provide powerful justification for needed resources and expanded pharmacist involvement.

**Design the program to meet the needs of patients.** The two examples above provide some insight into successful approaches to establishing an inpatient anticoagulation service. The consistent tenant of
### Table 1.
**Selected References Supporting Pharmacist Management of Heparin and Warfarin in the Inpatient Setting**

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Description</th>
<th>Key Effect of Pharmacist</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Pharmacist-dosed heparin using new weight-based protocol (n = 29) vs. physician (n = 14)</td>
<td>Earlier aPTT in target range (p &lt; 0.001) with fewer rate changes (p &lt; 0.001)</td>
<td>Small community hospital Decreased number of rate changes and days on heparin (NS) in a small study population</td>
</tr>
<tr>
<td>3</td>
<td>Pharmacist-adjusted heparin (n = 42) compared with physician-directed heparin (n = 42)</td>
<td>Pharmacist management achieved first aPTT value of &lt;1.5 earlier, shorter time to first aPTT 1.5–2 times normal, and fewer patients with aPTT values of &lt;1.5 or &gt;3 times normal; all p values &lt;0.05</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Pharmacy-based, computer-assisted heparin dosing (n = 131) compared with random historical cohort (n = 57) of 1992</td>
<td>Earlier time to target aPTT value (p &lt; 0.001)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Usual physician-directed care (n = 50) compared with pharmacist management (n = 50) of heparin and warfarin under protocol using independent nomograms for each agent</td>
<td>UFH: increased aPTT values in (p = 0.05) or below (p = 0.03) the target range Warfarin: decreased time to initiate therapy (p = 0.05) Reduction in total hospital costs (p = 0.05)</td>
<td>University hospital: fewer recurrent thrombosis and bleeding events at 3 mo postinitiation of anticoagulation INR more likely in the target range (2–3) at discharge</td>
</tr>
<tr>
<td>6</td>
<td>Usual physician-directed warfarin dosing (n = 60) matched for anticoagulation indication</td>
<td>Decreased critical INR values (&gt;3.5 or &gt;6.0, p &lt; 0.001) and length of hospital stay (p = 0.009)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Pharmacist-dosed (n = 74) warfarin after 4 days vs. physician (n = 64) having same protocol available</td>
<td>Improved INR control (p &lt; 0.001) with reduction in values of &gt;6 or &lt;2.0</td>
<td>Protocol refers patients on day 4 or before discharge to the outpatient clinic pharmacist for management Fewer INR values requested with improved control associated with pharmacist involvement</td>
</tr>
<tr>
<td>8</td>
<td>Protocol-driven dosing by pharmacist (n = 151) vs. physician independent of protocol (n = 41) in orthopedic surgery patients</td>
<td></td>
<td>Similar duration of inpatient therapy, with no difference in complication rates</td>
</tr>
<tr>
<td>9</td>
<td>Pharmacist-involved warfarin dosing consultation (n = 52) compared with prepharmacist involvement (n = 97)</td>
<td>Decreased number of aPTT or PT assays requested per day (p = 0.02) Increased PT values in target range at first outpatient follow-up (p = 0.001)</td>
<td>No difference in time to initiate UFH to warfarin or days of warfarin or heparin therapy</td>
</tr>
<tr>
<td>10</td>
<td>Pharmacist-assisted warfarin dosing protocol (n = 41) compared with physician-directed dosing (n = 46)</td>
<td>Decreased INR values of &gt;4 per patient (p = 0.0059)</td>
<td>Nonsignificant reduction in days to target INR or increase in INR values in target range favoring the pharmacist dose cohort. Cohorts unequally matched for anticoagulation indication</td>
</tr>
<tr>
<td>11</td>
<td>Inpatient pharmacist involved in collaborative process as part of discharge on low-molecular-weight heparin bridge therapy (n = 108) compared with historical control (n = 69) matched for injury severity in trauma</td>
<td>Reduced length in stay (p &lt; 0.002) and inpatient days on warfarin (p &lt; 0.0001)</td>
<td>Anticoagulation indication was DVT prophylaxis</td>
</tr>
</tbody>
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* aPTT = activated partial thromboplastin time, DVT = deep-vein thrombosis, INR = International Normalized Ratio, NS = not significant, PT = prothrombin time, UFH = unfractionated heparin.
both programs is they were designed to improve the care delivered to the patients they serve, in this case those receiving anticoagulants.

Adequate staffing. How should an anticoagulation service be staffed? Will the general pharmacists, clinical specialists, or others function in this role on a daily basis? Initial anticoagulation programs in some settings may function on a fairly small scale secondary to staffing limitations or the other hurdles of the constantly expanding demands being placed on pharmacy services. However, the opportunity for pharmacists to have any positive effect with potential improved safe use of anticoagulants and cost saving should not be overlooked. There are simple measures that can be implemented without huge increases in staffing. For example, all pharmacy departments should consider implementing a system that ensures

- Baseline laboratory tests are performed before anticoagulant administration. Examples include INRs, aPTTs, CBCs that include platelets.
- Laboratory values are reviewed before subsequent anticoagulant administration. Both institutions in the examples required a review of daily INRs and CBCs if available in addition to monitoring for symptomatic bleeding or thrombosis with warfarin use before dispensing the next warfarin dose, or automatic directives on monitoring aPTTs and CBCs with platelet values for adjusting heparin with continuous infusion guidelines.
- Standing prompts are put into the pharmacy computer system so all patients on anticoagulants are easily identified and drug interactions can be electronically captured, even if daily orders for a medication like warfarin are required.

Furthermore, keeping simple flow sheets of anticoagulant doses and selected laboratory values along with knowing the current medications can serve as a powerful tool to identify patients who need more in-depth case evaluation. Having such a record could assist in identifying problems encountered and serve as a tool to justify expanding the scope of the program.

Well-organized service. SMMC recently described the development of a Microsoft Access (Microsoft, Redmond, WA) database program to organize its service. This type of program allows the tracking of all active patients throughout the hospital. This helps each pharmacist identify which patient on anticoagulants requires an assessment and a care plan. Such data organization systems can also be designed to track the workload of the service for justification reasons.

Appropriate prescribing, monitoring, and management of anticoagulants. The increasing number of anticoagulation indications and treatment options, in addition to increased associated costs, has created new challenges in providing optimal, cost-effective therapy. Keeping current with newer assay methods, the expanding lists of interacting drugs or herbs, and the refined reversal strategies can be a challenge. The use of newer anticoagulants, such as the LMWHs, fondaparinux, or DTIs, has identified particular patient populations requiring different dosage regimens. When such agents are infrequently used among prescribers, having pharmacists with increased familiarity, pooled experience, and resources can optimize their use while minimizing potential oversights.

Once the magnitude of acute thromboembolic risk is weighed against the potential for a major hemorrhage event, anticoagulation therapy may be initiated and target goals established. Initial assessment of the management plan might include adjustment of dosage or target ranges for a specific patient based on the risk of thrombosis and bleeding or renal function. A parenteral agent is typically used initially for either thromboprophylaxis or treatment, followed by development of a plan for long-term anticoagulation if warranted.

Setting up an approach to monitor and adjust anticoagulation therapy on the basis of requested laboratory values and the dynamic presentation of the patient is key to achieving a successful outcome. Knowing the specific sensitivity and specificity or cross reactivity of the coagulation studies in the laboratory can assist in the interpretation of any reported result. When initiating continuous infusion of UFH or a DTI, weight-based dosing and selection of a time to measure the aPTT or activated clotting time should be considered. This would also include a careful analysis of the validity of the value as it reflects the dose and the determination of any necessary infusion rate changes.

Predetermining the time for follow-up values with reasonable information of the dose response (even if not at steady state) can be important in making dosage adjustments. Using values too close to the dose (i.e., within 8–12 hours after the warfarin dose), especially the first dose, or less than 4–6 hours after initiating heparin (especially if a bolus dose was administered and before achieving steady state) may not accurately reflect how the patient is responding. Although the studied elimination half-lives for DTIs in healthy patients are fairly short, most acutely ill patients may have a longer half-life where steady state may not be achieved within a few hours. Assessing the amount of drug required to achieve a desired response can identify a slow or rapid drug elimination rate. Low infusion rates would suggest reduced elimination and longer duration of effect after holding or prolonged time to achieve steady state and the opposite for high infusion rates.

Given all of the variables mentioned, how can the dosing of an-
Anticoagulants such as warfarin be standardized in the hospital setting, especially when the patient’s clinical presentation is acutely changing? The answer and treatment plan may not be simple. It may be desirable to have pharmacists incorporate as many of the multiple factors present when developing an anticoagulant management plan, while continually reassessing the need for any necessary revisions to meet the needs of the patient. Good communication among the prescriber, nursing staff, clinical laboratory, and pharmacist can create an environment that can improve patient care outcomes. It is vital that the approaches to monitoring anticoagulants not focus solely on the drug therapy but consider changes in the overall care plan and contribute to a multidisciplinary approach to optimize care.

Standardized use of anticoagulants. Selection of the anticoagulant should follow formulary guidelines set by the P&T committee based on indication, supporting efficacy data, and cost in the case of predetermined therapeutic equivalents. The pharmacist can be a resource for encouraging compliance with established policies. Pharmacists may also provide feedback on requests for laboratory tests that are unnecessary or in which results might create a misleading impression (e.g., protein C and protein S during active clotting or the presence of warfarin). In some cases, atypical laboratory tests may be suggested to identify less frequent, but potentially critical, conditions such as HIT or antithrombin deficiency. Having proactive pharmacist involvement in managing thrombosis can also create an opportunity to assist in optimizing the management of bleeding.39,40

For patients who are overanticoagulated and at risk of bleeding or require reversal of anticoagulation for an invasive procedure, management choices to reverse anticoagulant effects can make a difference in potential morbidity and mortality or length of hospital stay. For example, although vitamin K is relatively inexpensive, aggressive dosing may lead to prolonged inability to reestablish warfarin anticoagulation. This can create a notable financial burden to the health care system and society by prolonging hospital stays or creating a need for expensive parenteral bridge therapy in the outpatient setting until target warfarin effects are established. Having a strategy to limit the amount of vitamin K available outside the pharmacy (e.g., stocking only 1-mg ampuls of vitamin K in the emergency room) and a process to advise physicians on approaches to reverse therapy (low-dose i.v. or oral vitamin K instead of subcutaneous administration) can facilitate reversal goals in addition to addressing long-term anticoagulation goals. As UCDMC and SMMC have identified concerns with the use of recombinant factor VIIa, they have recognized that the anticoagulation service can be a resource for overseeing its use in the management of acute hemorrhagic events.

Continuity of care. When anticoagulation therapy is intended to extend beyond the inpatient setting, management approaches should include developing a plan for the transitional period and long-term follow-up. This may be especially critical when patients are discharged with overlapping therapies or have not been stabilized on warfarin. Educating patients before discharge, providing any additional training (e.g., the ability to administer subcutaneous injections), identifying who will be providing follow-up care, and making sure there is insurance coverage for the chosen anticoagulation regimen should be considered part of the management plan. Creating systems that coordinate both inpatient and outpatient management can have a notable effect on continued optimal care from the first day of anticoagulation to the completion of therapy. For example, SMMC uses the electronic tracking system already described to print a history report that is provided to the outpatient care provider to maintain continuity of care during the transition process.38 Pharmacists at UCDMC have electronic access to both inpatient and outpatient anticoagulation management records.

Implement the program and address unanticipated issues. All who are tasked with implementing an anticoagulation service should carefully plan their approach and targeted goals. The potential always exists that something will be missed or will not be anticipated. For this reason, start the service small on a unit where the greatest need and cooperation are perceived. Rapidly address all issues that arise so all care delivered is of the highest quality. Once the “bugs” are worked out of the system, roll the program out to other areas. Make sure the pharmacist is present to assist and does not develop a perception of hindering patient care.

Monitor the quality of the program and strive for improvement. It is important to collect and analyze data from your program to improve performance. A very helpful feature of the SMMC computer organization program is the ability to generate indicators on the quality of service provided.34 This allows for continuing quality improvement of the program. Currently, SMMC tracks the percentage of INRs that are greater than 3.5, greater than 6, and the percentage of INRs in therapeutic range. These data are trended over time so the department can ascertain if the quality of the program is consistent. The P&T committee and quality-of-care administrators interested in the performance of the pharmacy anticoagulation program should review all objective data generated by the program and propose solutions for areas identified for improvement. Documentation of these activities will likely create ongoing high-level support of the program.
Anticoagulation management

Expand as the patient need arises. Although the initial inpatient pharmacists’ anticoagulation roles focused on warfarin and heparin, the emergence of newer anticoagulants or assay methods, reversal strategies, and recognition of different approaches to their use has created new roles for pharmacists. For example, LMWHs, while clearly an advance over UFH, do require that important issues such as renal function and eminent bleeding concerns be taken into consideration before prescribing. This is a key role that the pharmacists in both institutions address. The numerous potential anticoagulants in development will continue to create ongoing challenges in deciding which anticoagulation approach to use, including transitioning among agents and the cost of the therapy to the health care system. Another challenge with newer agents is identifying patients who may or may not be best suited for a given agent, considering the potential risks. This especially may be the case with a patient receiving the agent who had been excluded from receiving the therapy in clinical trials. The pharmacist is in a key position to implement the policies of the health systems’ P&T committee or other governing committee responsible for determining the appropriate agent and its use.

Conclusion

Requirements for establishing a successful inpatient anticoagulation management program included defining the pharmacist’s role in identifying patient needs, gaining support from other health care professionals, designing a program that addresses the needs of patients, and managing unanticipated issues.

References


