Supporting documentation for Group B practices
Interdisciplinary Treatment and Monitoring Guidelines

Standard guidelines should be developed and implemented to direct the safe and appropriate use of unfractionated heparin, low-molecular weight heparin, and warfarin. The guidelines should include, but are not limited to:

- Indications
- Therapeutic ranges of INR/aPTT for each indication
- Contraindications
- Responsibility for dosing/monitoring during hospitalization and at discharge
- Initial and subsequent dosing based on indication (including bolus doses of heparin)
- Dosing for patients with comorbid conditions (e.g., renal impairment, liver disease, hyperthyroidism)
- Titration of heparin (e.g., standard dose adjustment intervals)
- Dosing of warfarin (e.g., standard dose adjustments)
- Bridge protocol for transition from heparin to warfarin
- Monitoring guidelines (e.g., type of tests for baseline before, during, and after therapy, frequency of testing)
- Indications for holding the anticoagulant based on therapeutic range per indication
- Repeat blood drawing and testing if INR or aPTT results do not appear to correlate with the clinical status of the patient
- Drug/herbal/disease-state interactions, including effects
- Reminders to discontinue low-molecular weight heparin before starting a heparin infusion
- Indications and directions for standard (before planned procedure) and rapid (emergency) reversal of anticoagulation
- Warnings about potential adverse effects with IV administration of vitamin K and specific guidelines to reduce these risks
- Directions for resumption of anticoagulation after reversal of anticoagulant effects, taking into account prolonged resistance to anticoagulant up to 1 week
- Strategies for preventing and treating IV/arterial infiltration and/or hematoma at injection site
• Strategies for preventing epidural or spinal hematomas when neuraxial anesthesia or spinal puncture is employed
• Length of time before initiating heparin therapy if a patient has received a prior dose of low-molecular weight heparin, and vise versa
• Drug dispensing guidelines, including safe labeling practices
• Drug administration guidelines, including documentation of all heparin flushes on the patient’s medication administration record
• Diagnosis and treatment of heparin-induced thrombocytopenia

Strategy for handling “hold” orders

Anticoagulants may need to be held for a short time to reduce the risk of bleeding (e.g., before surgery or a procedure, when INR or aPTT elevated). Sometimes, an order to hold the anticoagulant results in either forgetting to resume it, when appropriate, or resuming it too soon. A standard procedure should be established for handling “hold” orders to reduce the risk of bleeding or thrombus. The treatment guidelines should include, but are not limited to, the following:

• For daily warfarin doses based on daily lab results, list the order in the pharmacy profile and medication administration record (MAR) as an active order with a note that a daily dose should be prescribed. If a dose must be held, an order for “no warfarin today” should be received and documented on the pharmacy profile and MAR
• When heparin infusions are stopped for a designated period of time, establish a process to remind staff members when the infusion should be restarted
• If the anticoagulant dose is not guided by daily lab values, hold orders should include instructions on when to resume the medication
• Reorder and reconcile post-procedure anticoagulants
• Include prompts to reorder anticoagulants in post-procedure standardized order sets when applicable (e.g., total hip and knee arthroplasty)
• In the outpatient setting, track medications placed on hold, and contact patients regarding instructions for resuming the medication (or provide patients with explicit directions for resuming the medication when communicating the need to hold the medication [e.g., hold for today and resume 2 mg daily tomorrow])
Tell outpatients (and inpatients who self-medicate) when to expect a call for further directions regarding their anticoagulant and, if not received, to alert the nurse or physician.

Protocol and/or preprinted orders for evaluation and treatment of heparin-induced thrombocytopenia (HIT)

Heparin-induced thrombocytopenia (HIT) can be defined as any clinical event best explained by platelet factor 4 (PF4)/heparin-reactive antibodies ('HIT antibodies') in a patient who is receiving, or who has recently received heparin. A high proportion of patients with HIT develop thrombosis. A protocol/preprinted orders should be established and followed for all patients suspected to have HIT/diagnosed with HIT. The protocol/preprinted orders should include, but are not limited to:

- Diagnostic tests for HIT
- Ongoing laboratory monitoring specific to medications prescribed (including direct thrombin inhibitors)
- Indications for alternative (nonheparin) anticoagulant therapy, including direct thrombin inhibitors
- Diagnostic tests for deep-vein thrombosis (e.g., routine US of lower extremities)
- Communication of diagnosis to all healthcare providers
- Discontinuation of all sources of heparin (e.g., arterial line infusions, heparin flushes, heparin-coated catheters/instruments).

Strategically placed independent double checks

While technological solutions such as computerized prescriber order entry and bar coding systems have great potential to detect human error, manual redundancies such as independent double checks still play an important role in error detection. Studies show that manual redundancies detect about 95% of errors. While the 5% of errors that get through human detection systems make it unreliable as a single error prevention strategy, it may be the only way to detect a serious error. Most often, independent double checks should be reserved for potentially harmful errors that are just one failure deep, or unlikely to be detected by other means or practitioners. For anticoagulants, independent double checks are best performed as follows:
• Independent double check of the drug, concentration, dose calculations, rate of infusion, pump settings, line attachment, and patient identity before the start of a heparin infusion and with each change of the bag or rate (If using “smart pumps,” a manual double check should still be performed at the bedside to verify the line attachment)
• Independent double check of all admixtures involving heparin in the pharmacy (including the addition of heparin to TPN or other electrolyte solutions)
• Independent double check or bar-coded verification process for anticoagulants placed into automated dispensing cabinets or clinical unit stock shelves/bins
• Independent double check of heparin flush solution if it requires dilution (dilution, if necessary, should occur in the pharmacy, not on clinical units).

**Restricted access to multiple concentrations of heparin**

Constraints that limit access to multiple concentrations of heparin make it hard for practitioners to select and administer the wrong strength of the drug. As an example, an organization might review all the concentrations of heparin available in vials and determine that a particular strength, such as 10,000 units/mL, is not really needed. Eliminating this strength reduces the risk of mistaking it as a vial containing 1,000 units/mL or 100 units/mL. Another example of this safeguard is to restrict nursing access to multiple concentrations of heparin through pharmacy dispensing of all required doses/flushes.

**Safe selection, procurement, and storage of anticoagulants**

The selection, procurement, and storage of anticoagulants should be given careful consideration to limit unnecessary access to the drugs and to prevent drug selection errors. All unsafe storage conditions cannot be determined without ongoing safety rounds to all areas where anticoagulants are stored (including the pharmacy). Likewise, all anticoagulants with look-alike packaging and/or names cannot be determined without knowledge of all products used and without a pre-assessment of new products before use. However, a few examples of actions that can be taken to enhance safe selection, procurement, and storage of anticoagulants follow:
• Do not store heparin vials on top of medication carts and counters, or under laminar flow hoods in the pharmacy; return the vials to the proper storage area immediately after use.
• Do not store heparin solutions used for arterial lines (e.g., 1,000 units/500 mL) near other injectable solutions (e.g., 25,000 units/500 mL).
• Separate the storage of heparin syringes from other look-alike syringes in the pharmacy and clinical units.
• Separate heparin and insulin vials, which are both measured in units and may have a similar 100 unit/mL concentration, adding to the potential for confusion.
• Separate Hespan, lidocaine, magnesium sulfate, and heparin infusions (look-alike packaging).
• Use tall-man letters on auxiliary labels, automated dispensing screens, and order entry screens to differentiate HeSpan and hEParin.
• Evaluate the packaging and labels on all heparin/warfarin products to identify any potential for confusion and remedy problems by repackaging, affixing auxiliary labels, or switching manufacturers to improve distinction and clarity of labeling and packaging.

Prevent unsafe concomitant administration of anticoagulants

Some anticoagulants and thrombolytic or GIIb/3A inhibitor medications can be administered together as long as appropriate dose adjustments are made to the anticoagulants to reduce the risk of bleeding. However, concomitant use of heparin products, particularly low-molecular weight heparin and unfractionated heparin, has been deadly. These occurrences often involve the administration of one heparin product in the emergency department and another on the patient care unit after admission, without discontinuation of the prior heparin product, or administering one product too close in time to the other product. The following steps can be taken to reduce the risk of administering heparin products together:

• Include reminders on protocols, guidelines, and standard order forms for heparin, warfarin, and fibrinolytics to assess all drug therapy to avoid concomitant use of heparin products.
• Ensure that computer alerts for duplicate therapy are fully functional for all heparin products.
• Require consistent documentation of medications administered in the emergency department (ED) and cardiac catheterization lab in a single, standardized place (not embedded within nursing notes) to facilitate review of all drug therapy before a heparin product is prescribed or administered.

• Establish a process for immediate communication to the pharmacy, upon a patient's admission to the hospital, of all medications administered in the emergency department or other outpatient settings (e.g., cardiac catheterization lab), to ensure that these medications are in the pharmacy computer system and will generate an automated alert for duplicate therapy or interactions with medications prescribed upon admission.

(With many pharmacy computer systems, a one-time drug order becomes inactive as soon as it is dispensed, and only active orders are checked for duplicate therapy and drug interactions. To bypass this problem, some pharmacists enter one-time doses of low-molecular weight heparin as a set of two "orders": (1) one order for the low-molecular weight heparin as prescribed and administered in the ED, and (2) a note that the patient has received low-molecular weight heparin, along with the National Drug Code (NDC) number that triggers an interaction alert and a suggested frequency that keeps the order active for about 12 hours. Thus, an interaction message will occur if another heparin product is prescribed within that time frame. Modifications for different computer systems may be necessary, but many systems allow such a safety net to be built.)

Inpatient clinical pharmacy anticoagulation services and outpatient dosing services

*Inpatient anticoagulation services* for both heparin and warfarin typically consist of pharmacist-run programs that provide daily pharmacy input on dosing and monitoring of patients receiving heparin and/or warfarin. Studies have shown that adverse drug events, particularly bleeding and thromboembolic events, were significantly lessened in patients who were managed through the pharmacy. Allowing pharmacists to manage an anticoagulation service also results in greater efficiency for pharmacists, nurses, and physicians, who don't have to make calls to report labs or check for changes in dosing orders. Once established, the inpatient service should
be closely coordinated with an outpatient warfarin dosing service and should provide the outpatient service with necessary information upon discharge (e.g., diagnosis, target INR, duration of therapy, list of other medications prescribed at discharge).

*Outpatient anticoagulation clinics* manage outpatient warfarin therapy. Services typically include anticoagulation monitoring and follow-up, warfarin dose adjustment, and patient education. These clinics are usually run by pharmacists or nurses operating with physician back-up, and sometimes following specific dosing nomograms.

**Use process control charts**

To clearly visualize trends and ensure minimal variation in therapeutic anticoagulant levels, plot INR values on process control charts. Set upper and lower control limits (typically two to three standard deviations above and below the target INR) that signal the need for a dose adjustment if the threshold is breached two or more consecutive times.

**Coagulation test results in 2 hours**

Since dose adjustments may be warranted, laboratory test results should be available for review on the patient’s record within 2 hours, and critical lab results should be called to a responsible party as soon as recognized. Improving the way tests are collected, transported, analyzed, and reported could result in more timely notification of lab values. If laboratory services are not available on site or around the clock, use of bedside testing equipment should be considered if its use will be consistent enough to maintain staff competency. Lab reports should provide all values over time, preferably along with a computer-generated statistical process control chart that can help identify trends. If the patient was on anticoagulants before admission and the outpatient lab results are available, include these data to cover a longer period of time.

**Teach patients self-monitoring and administration of prescribed anticoagulants**

Studies have shown that knowledgeable patients have encountered less adverse drug events. Engaging patients in their own care and safety by
ensuring that they understand how to take the medication, other medications that should be avoided, and identification of symptoms that signal harm is critical. Some patients are also able to manage their own anticoagulation quite successfully, although these patients must be able to understand the lab testing required and the dosing using a standard nomogram.

To promote patient participation in his or her care:

- Arrange the first lab appointment and follow-up physician office visit before discharge from the hospital; enroll the patient in an outpatient warfarin dosing service if available.
- Encourage patients to keep a medication diary or home medication administration record to document all doses administered and to better track alternating or changing doses.
- Allow patients to begin the self administration process while in the hospital.
- Provide patients with anticoagulation flow sheets used in the hospital and flow sheets that have been designed for weekly dosing regimens after discharge when their therapeutic levels are stable.
- Educate patients about food and drug interactions and who to call if they have questions (An established food/drug interaction educational program for warfarin should be implemented upon notification to dietary of all patients receiving warfarin).
- Teach patients the signs of bleeding and who/when to call for help.
- Encourage patients to maintain an updated list of all current medications, over-the-counter products, including herbals and vitamins, and to bring the list to the hospital and pharmacy.
- For motivated patients, provide training to use self-monitoring equipment at home and to adjust their doses accordingly.