

# Anticoagulation Vulnerability

## Introduction

The medication use process is one of the most complicated processes in health care, with anticoagulant use being among the most difficult of all therapies to manage. The addition of new pharmacologic agents (low molecular weight heparins, antiplatelet drugs, thrombolytics, direct thrombin inhibitors, etc.), the introduction of brand new drug entities without adequate drug interaction information, and new interventional procedures (stents, grafts, valves, etc) further complicate this mode of therapy. The challenge of safe anticoagulation therapy requires a good balance between thrombosis and bleeding in order to assure that patients receive the most benefit from therapy. Introduction of weight based heparin protocols have generally improved the time to reach the therapeutic range for many patients, but they may not be appropriate for all patients. If patients have risk factors for bleeding, they may be predisposed to bleeding if the protocols are not sufficiently adjusted to accommodate for the increased risk of bleeding. Some patients may have higher risk of bleeding that may not be outweighed by the benefit of anticoagulation. Much more research in this field is necessary.

## Common Processes that seem to be problem prone

- Calculation and set up of heparin doses
- Multiple methods to order anticoagulants (CPRS, protocols, text orders, etc)
- Failure to appreciate half lives and peak effect times of various drugs (e.g. today's dose effects day after tomorrow's lab)
- Absolute and relative contraindications to anticoagulation (up to date risk: benefit ratios)
- Selection of intensity of anticoagulation to meet the risk benefit ratio
- Timing and reporting and evaluation of PTT results (often drawn before steady state)
- Specimen collection (adequate volume, appropriate site of phlebotomy)
- Transition therapy for outpatients needing reversal of warfarin for outpatient procedures or surgery
- Transition therapy for inpatients from heparin therapy to warfarin
- Reversal of anticoagulant effect with protamine, Vitamin K, or FFP (to reverse or to wait and see)
- Vitamin K dosing and administration (too high a dose leads to prolonged warfarin resistance)
- Therapy with new drugs that interact with anticoagulants (inadequate information about drug interactions)
- Patient compliance with anticoagulant regimen (drug therapy, diet, monitoring)
- Alternative medicines and risk of drug interactions and bleeding
- Enteral supplements and protein binding effects with warfarin
- Monitoring for side effects (CBC, HBG, PLT, thrombocytopenia, etc and frank bleeding)

- Medication use systems - floor stock and infusion devices
- Lack of double check systems (infusion device, calculations, loading dose, etc)
- IV compatibility and infusion related interruption issues
- Flow of information (need paper or electronic flow sheet similar to diabetes or ICU care)

## Actions Taken to Control Vulnerability

Actions from both VA and non-VA facilities:

- Establish weight based heparin protocols (to improve consistency) with education on exclusion and inclusion criteria. Close monitoring for success and failures and adjustment of protocol as necessary is commonly seen.
- Use anticoagulant cases as grand rounds and teaching cases for medical, nursing and pharmacy staff
- Establish a food and drug interaction program / policy which addresses enteral feedings and warfarin administration
- Establish a pharmacy based inpatient anticoagulation service to improve monitoring, follow up and transitioning to warfarin
- Establish double check systems to verify correct pump settings and calculations
- Limit the availability of anticoagulant drugs from floor stock to reduce misadministration and force review of the order before drug administration
- Limit the availability of reversal agent drugs from floor stock to reduce misadministration
- Use manufacturer's pre-made solutions to reduce compounding and labeling errors
- Standardize on one size /concentration of IV bag for continuous IV heparin using an even number of units per ml [e.g. 50 units per ml] to simplify calculations
- Include drip charts on the infusion bags to improve the ability to adjust rates without mathematical error
- Limit the size of the infusion bag of heparin to reduce risk if free flow or over infusions occur (250 ml versus 500 ml)
- Provide heparin in dosage forms that are as close as possible to what is ordered (e.g. 5,000 or 10,000 unit vials for bolus use)
- Standardize the monitoring of anticoagulant laboratory work so that clinical changes are detected early (Hemoglobin, platelets, etc)
- "Super train" phlebotomy, nursing or IV therapy staff in venipuncture and specimen collection related to anticoagulant labs and use these resource people as the leaders for this task (similar to blood culture teams, etc.)

- Develop self-learning modules or CE programs on anticoagulant safety
- Review out of range INR/ PTT results on a periodic basis as a group to identify system issues before they result in injury
- Flowchart and redesign the hospital's process for anticoagulation focusing on vulnerability elimination and simplification

### System Components in Anticoagulation Outcomes

