Anticoagulation Therapy: Patient Safety and Evolving Regulatory Requirements

Kenneth E. Wood, D.O.
Medical Director – Anticoagulation Management Stewardship Program

Anne Rose, Pharm.D.
Coordinator - Anticoagulation Management Stewardship Program

University of Wisconsin Hospitals and Clinics
November 4, 2009
Learning Objectives

• Discuss the outcomes data surrounding anticoagulant therapy
• Describe the risks involved in the use of anticoagulants
• Review current regulatory requirements and processes for meeting them
Venous Thromboembolism

“The detachment of larger or smaller fragments from the end of the softening thrombus are carried along by the current of blood and driven in remote vessels. This gives rise to the very frequent process upon which I have bestowed the name EMBOLIA.”

Virchow 1846

Vessel Injury ▼ Stasis ▼ Hyper-coagulability

Acquired △ Inherited
## Absolute Risk of DVT in Hospitalized Patients Non-prophylaxed

<table>
<thead>
<tr>
<th>Patient Group</th>
<th>DVT Prevalence, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical patients</td>
<td>15 – 20</td>
</tr>
<tr>
<td>General surgery</td>
<td>15 – 40</td>
</tr>
<tr>
<td>Major gynecologic surgery</td>
<td>15 – 40</td>
</tr>
<tr>
<td>Major urologic surgery</td>
<td>15 – 40</td>
</tr>
<tr>
<td>Neurosurgery</td>
<td>15 – 40</td>
</tr>
<tr>
<td>Stroke</td>
<td>20 – 50</td>
</tr>
<tr>
<td>Hip or knee arthroplasty, hip fracture surgery</td>
<td>40 – 60</td>
</tr>
<tr>
<td>Major trauma</td>
<td>40 – 80</td>
</tr>
<tr>
<td>Spinal cord injury</td>
<td>60 – 80</td>
</tr>
<tr>
<td>Critical care patients</td>
<td>10 – 80</td>
</tr>
</tbody>
</table>

Geerts CHEST 126(3); Supplement: 338S-400S
Surgery Specific Risk Factors

• Blood Flow (Stasis)
  • Significant ↓ clearance venographic contrast soleal sinuses calf, or > recumbent > upright\(^1\)
  • Vasodilatory effects of anesthesia ↑ venous capacitance 2X blood volume legs\(^2\)
  • Duration of anesthesia\(^3\)

• Intimal Injury
  • Vasodilatation by vasoactive amines and anesthesia → intimal injury with focal tears on venous endothelium \(^4,5,6\)

• Hypercoagulability
  • ↓ Venous return ↓ clearance of clotting factors
  • Hypoxia of valve pockets → endothelial damage\(^7\)
  • ↑ Coag activation ↑ platelet activity ↓ endogenous anticoagulants ↓ fibrinolysis

5. Stewart Arch Pathol Lab Med 1980; 104: 409-13
Natural History of DVT

132 Surgical patients no prophylaxis

- 70% No DVT (92)
- 30% DVT (40)
  - 35% Calf with spontaneous lysis (14)
  - 42% Calf only (17)
  - 23% propagation Popliteal/femoral (9)
  - 56% No PE (5)
  - 44% PE (4)

Kakkar Lancet 1969; 6:230-32
Sequelae of Acute DVT

Recurrent Event

- Cancer (1.72) and hypercoag (1.44) ↑ hazard ratio
- Surgery (0.36) and recent trauma/fracture (0.51) ↓ hazard ratio

Year 2: 17.5%
Year 5: 24.6%
Year 8: 30.3%

Post Thrombotic Syndrome

- Ipsilateral recurrent DVT (6.4) ↑ hazard ratio

Year 2: 22.8%
Year 5: 28%
Year 8: 29.1%

# Cost of Deep Venous Thrombosis

<table>
<thead>
<tr>
<th>Complication</th>
<th>#</th>
<th>LOS</th>
<th>Day</th>
<th>Stay</th>
<th>Post</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>1387</td>
<td>4.5</td>
<td>$820</td>
<td>$3486</td>
<td>$1616</td>
<td>$5102</td>
</tr>
<tr>
<td>Major Bleed</td>
<td>287</td>
<td>8.6</td>
<td>$1460</td>
<td>$11,189</td>
<td>$5980</td>
<td>$17,168</td>
</tr>
<tr>
<td>Moderate Bleed</td>
<td>410</td>
<td>6.9</td>
<td>$1174</td>
<td>$7980</td>
<td>$4162</td>
<td>$12,142</td>
</tr>
<tr>
<td>Pulmonary Embolism</td>
<td>725</td>
<td>7.5</td>
<td>$1320</td>
<td>$9476</td>
<td>$5173</td>
<td>$14,649</td>
</tr>
<tr>
<td>Thrombocytopenia</td>
<td>143</td>
<td>6.6</td>
<td>$1378</td>
<td>$8679</td>
<td>$4790</td>
<td>$13,459</td>
</tr>
<tr>
<td>None of 4 above</td>
<td>27,321</td>
<td>5.4</td>
<td>$1020</td>
<td>$5561</td>
<td>$4223</td>
<td>$9,785</td>
</tr>
<tr>
<td>All DVT</td>
<td>29,295</td>
<td>5.8</td>
<td>$1036</td>
<td>$5779</td>
<td>$4293</td>
<td>$10,072</td>
</tr>
</tbody>
</table>

Adapted from Caro Pharmacoeconomics 2002; 20:603-615 and Caro Venous Thromboembolism Lung Biology In Health and Disease 2003
2nd Annual Patient Safety in American Hospitals Report

- 2001-03; 39 million Medicare admissions

**Postop DVT/PE:**

- Number of TE events: 111,543
- % of all Pat Safety Indicators: 9.5%
- Mortality rate: 11.8%*
- Deaths attributable to DVT/PE: 7,317
- Costs attributable to DVT/PE: $2.4 billion

* 4% without a PSI

Health Grades, Inc (2005) www.healthgrades.com
<table>
<thead>
<tr>
<th>Patient Safety Target</th>
<th>Greatest Strength of Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venous thromboembolism (VTE)</td>
<td>Appropriate VTE prophylaxis</td>
</tr>
<tr>
<td>Perioperative cardiac events in patients undergoing noncardiac surgery</td>
<td>Use of perioperative β-blockers</td>
</tr>
<tr>
<td>Central venous catheter–related bloodstream infections</td>
<td>Use of maximum sterile barriers during catheter insertion</td>
</tr>
<tr>
<td>Surgical site infections</td>
<td>Appropriate use of antibiotic prophylaxis</td>
</tr>
<tr>
<td>Missed, incomplete, or not fully comprehended informed consent</td>
<td>Asking that patients recall and restate what they have been told during informed consent</td>
</tr>
<tr>
<td>Ventilator-associated pneumonia</td>
<td>Continuous aspiration of subglottic secretions (CASS)</td>
</tr>
<tr>
<td>Pressure ulcers</td>
<td>Use of pressure-relieving bedding materials</td>
</tr>
<tr>
<td>Morbidity due to central venous catheter insertion</td>
<td>Use of real-time ultrasound guidance during central line insertion</td>
</tr>
<tr>
<td>Adverse events related to chronic anticoagulation with warfarin</td>
<td>Patient self-management using home monitoring devices</td>
</tr>
<tr>
<td>Morbidity and mortality in post-surgical and critically ill patients</td>
<td>Various nutritional strategies</td>
</tr>
<tr>
<td>Central venous catheter–related bloodstream infections</td>
<td>Antibiotic-impregnated catheters</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>High Strength of Evidence</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality associated with surgical procedures</td>
<td>Localizing specific surgical procedures and procedures to high-volume centers</td>
</tr>
<tr>
<td>Ventilator-associated pneumonia</td>
<td>Semirecumbent positioning</td>
</tr>
<tr>
<td>Falls and fall injuries</td>
<td>Use of hip protectors</td>
</tr>
<tr>
<td>Adverse drug events (ADEs) related to targeted classes (analgesics, potassium chloride, antibiotics, heparin) (focus on detection)</td>
<td>Use of computer monitoring for potential ADEs</td>
</tr>
<tr>
<td>Surgical site infections</td>
<td>Use of supplemental perioperative oxygen</td>
</tr>
<tr>
<td>Morbidity and mortality</td>
<td>Changes in nursing staffing</td>
</tr>
<tr>
<td>Missed or incomplete or not fully comprehended informed consent</td>
<td>Use of video or audio stimuli</td>
</tr>
<tr>
<td>Ventilator-associated pneumonia</td>
<td>Selective decontamination of digestive tract</td>
</tr>
<tr>
<td>Morbidity and mortality in intensive care unit (ICU) patients</td>
<td>Change in ICU structure—active management by intensivist</td>
</tr>
<tr>
<td>Adverse events related to discontinuities in care</td>
<td>Information transfer between inpatient and outpatient pharmacy</td>
</tr>
<tr>
<td>Hospital-acquired urinary tract infection</td>
<td>Use of silver alloy–coated catheters</td>
</tr>
<tr>
<td>Hospital-related delirium</td>
<td>Multicomponent delirium prevention program</td>
</tr>
<tr>
<td>Hospital-acquired complications (functional decline, mortality)</td>
<td>Geriatric evaluation and management unit</td>
</tr>
<tr>
<td>Inadequate postoperative pain management</td>
<td>Nonpharmacological interventions (eg, relaxation, distraction)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Medium Strength of Evidence</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Medication errors and ADEs primarily related to ordering process</td>
<td>Computerized physician order entry (CPOE) and clinical decision support (ODSS)</td>
</tr>
<tr>
<td>Failures to communicate significant abnormal results (eg, Pappanicolaou smears)</td>
<td>Protocols for notification of test results to patients</td>
</tr>
<tr>
<td>Adverse events due to transportation of critically ill patients between health care facilities</td>
<td>Specialized teams for interhospital transport</td>
</tr>
<tr>
<td>Medication errors and ADEs related to ordering and monitoring</td>
<td>Clinical pharmacist consultation services</td>
</tr>
<tr>
<td>Serious nosocomial infections (eg, vancomycin-resistant enterococcus, Clostridium difficile)</td>
<td>Barrier precautions (via gowns and gloves; dedicated equipment; dedicated personnel)</td>
</tr>
<tr>
<td>Surgical site infections</td>
<td>Perioperative glucose control</td>
</tr>
<tr>
<td>Stress-related gastrointestinal bleeding</td>
<td>H2 antagonists</td>
</tr>
<tr>
<td>Pneumococcal pneumonia</td>
<td>Methods to increase pneumococcal vaccination rate</td>
</tr>
<tr>
<td>Inadequate pain relief</td>
<td>Acute pain service</td>
</tr>
<tr>
<td>Adverse events related to anticoagulation</td>
<td>Anticoagulation services and clinics for coumadin</td>
</tr>
<tr>
<td>Hospital-acquired infections due to antibiotic-resistant organisms</td>
<td>Limitations placed on antibiotic use</td>
</tr>
<tr>
<td>Hospital-acquired urinary tract infection</td>
<td>Use of suprapubic catheters</td>
</tr>
<tr>
<td>Contrast-induced renal failure</td>
<td>Hydration protocols with acetylcysteine</td>
</tr>
<tr>
<td>Clinically significant misread radiographs and computed tomography scans by radiologists</td>
<td>Education interventions and continuous quality improvement strategies</td>
</tr>
<tr>
<td>Missed or incomplete or not fully comprehended informed consent</td>
<td>Provision of written informed consent information</td>
</tr>
<tr>
<td>Failure to honor patient preferences for end-of-life care</td>
<td>Computer-generated reminders to discuss advance directives</td>
</tr>
<tr>
<td>Adverse events related to anticoagulation</td>
<td>Protocols for high-risk drugs: nomograms for heparin</td>
</tr>
<tr>
<td>Ventilator-associated pneumonia</td>
<td>Continuous oscillation</td>
</tr>
<tr>
<td>Surgical site infections</td>
<td>Maintenance of perioperative normothermia</td>
</tr>
<tr>
<td>Restrained-related injury, falls</td>
<td>Interventions to reduce the use of physical restraints safely</td>
</tr>
<tr>
<td>Falls</td>
<td>Use of bed alarms</td>
</tr>
<tr>
<td>Contrast-induced renal failure</td>
<td>Use of low osmolar contrast media</td>
</tr>
</tbody>
</table>
Venous Thromboembolism Prophylaxis

• Agency for Healthcare Research and Quality
  “Appropriate use of prophylaxis to prevent venous thromboembolism in patients at risk” (#1 ranked safety intervention)

• ACCP Conference on Antithrombotic and Thrombolytic Therapy (2008)
  • Recommends that every hospital develop a formal strategy that addresses the prevention of thromboembolic complications. This should be in the form of a written thromboprophylaxis policy

• JCAHO ICU Core Measures-DVT Prophylaxis
Joint Commission Venous Thromboembolism (VTE) Measures

VTE-1: Venous Thromboembolism Prophylaxis

*Numerator:* Patients who received VTE prophylaxis or have documentation why no VTE prophylaxis was given:
- The day of or the day after hospital admission
- The day of or the day after surgery end date for surgeries that start the day of or the day after hospital admission

*Denominator:* All patients

VTE-2: Intensive Care Unit Venous Thromboembolism Prophylaxis

*Numerator:* Patients who received VTE prophylaxis or have documentation why no VTE prophylaxis was given:
- The day of or the day after ICU admission (or transfer)
- The day of or the day after surgery end date for surgeries that start the day of or the day after ICU admission (or transfer)

*Denominator:* Patients directly admitted or transferred to ICU
Joint Commission Venous Thromboembolism (VTE) Measures

VTE-3: Venous Thromboembolism Patients with Anticoagulation Overlap Therapy

*Numerator:* Patients who received overlap therapy

*Denominator:* Patients with confirmed VTE who received warfarin

VTE-4: Venous Thromboembolism Patients Receiving Unfractionated Heparin with Dosages/Platelet Count Monitoring by Protocol or Nomogram

*Numerator:* Patients who have their IV UFH therapy dosages AND platelet counts monitored according to defined parameters such as a nomogram or protocol

*Denominator:* Patients with confirmed VTE receiving IV UFH therapy
Joint Commission Venous Thromboembolism (VTE) Measures

VTE-5: Venous Thromboembolism Discharge Instructions

*Numerator:* Patients with documentation that they or their caregivers were given written discharge instructions or other educational material about warfarin addressing all of the following:

1. Compliance issues
2. Dietary advice
3. Follow-up monitoring
4. Potential for adverse drug reactions and interactions

*Denominator:* Patients with confirmed VTE discharged on warfarin therapy

VTE-6: Incidence of Potentially-Preventable Venous Thromboembolism

*Numerator:* Patients who received no VTE prophylaxis prior to the VTE diagnostic test order date

*Denominator:* Patients who developed confirmed VTE during hospitalization
1.2.1. For every general hospital, we recommend that a formal, active strategy that addresses the prevention of VTE be developed (Grade 1A).

1.2.2. We recommend that the local thrombo-prophylaxis strategy be in the form of a written, institution-wide thromboprophylaxis policy (Grade 1C).

1.2.3. We recommend the use of strategies shown to increase thromboprophylaxis adherence, including the use of computer decision support systems (Grade 1A), preprinted orders (Grade 1B), and periodic audit and feedback (Grade 1C). Passive methods such as distribution of educational materials or educational meetings are not recommended as sole strategies to increase adherence to thromboprophylaxis (Grade 1B).
ACCP Mechanical Methods of Thromboprophylaxis

1.4.3.1. We recommend that mechanical methods of thromboprophylaxis be used primarily in patients at high risk for bleeding (*Grade 1A*), or possibly as an adjunct to anticoagulant-based thromboprophylaxis (*Grade 2A*).

1.4.3.2. For patients receiving mechanical methods of thromboprophylaxis, we recommend that careful attention be directed toward ensuring the proper use of, and optimal adherence with, these methods (*Grade 1A*).
Aspirin as Thromboprophylaxis

1.4.4. We recommend against the use of aspirin alone as thromboprophylaxis against VTE for any patient group (Grade 1A).

Anticoagulant Dosing

1.4.5. For each of the antithrombotic agents, we recommend that clinicians follow the manufacturer-suggested dosing guidelines (Grade 1C).
Renal Impairment and Anticoagulant Dosing

1.4.6. We recommend that renal function be considered when making decision about the use and/or the dose of LMWH, fondaparinux, and other antithrombotic drugs that are cleared by the kidneys, particularly in elderly patients, patients with diabetes mellitus, and those at high risk for bleeding (Grade 1A). Depending on the circumstances, we recommend one of the following options in this situation: avoiding the use of an anticoagulant that bioaccumulates in the presence of renal impairment, using a lower dose of the agent, or monitoring the drug level or its anticoagulant effect (Grade 1B).
1.5.1. For all patients undergoing neuraxial anesthesia or analgesia, we recommend appropriate patient selection and caution when using anticoagulant thromboprophylaxis (Grade 1A).

1.5.2. For patients receiving deep peripheral nerve blocks, we recommend that the same cautions considered for neuraxial techniques be applied when using anticoagulant thromboprophylaxis (Grade 1C).
## Levels of Thromboembolism Risk and Recommended Thromboprophylaxis in Hospital Patients*

<table>
<thead>
<tr>
<th>Levels of Risk</th>
<th>Approximate DVT Risk Without Thromboprophylaxis, %†</th>
<th>Suggested Thromboprophylaxis Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low risk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minor surgery in mobile patients</td>
<td>&lt; 10</td>
<td>No specific thromboprophylaxis</td>
</tr>
<tr>
<td>Medical patients who are fully mobile</td>
<td></td>
<td>Early and “aggressive” ambulation</td>
</tr>
<tr>
<td>Moderate risk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Most general, open gynecologic or urologic surgery patients</td>
<td>10 – 40</td>
<td>LMWH (at recommended doses), LDUH bid or tid, fondaparinux</td>
</tr>
<tr>
<td>Medical patients, bed rest or sick</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate VTE risk plus high bleeding risk</td>
<td></td>
<td>Mechanical thromboprophylaxis§</td>
</tr>
<tr>
<td>High risk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hip or knee arthroplasty, HFS</td>
<td>40 – 80</td>
<td>LMWH (at recommended doses), fondaparinux, oral vitamin K antoagonist (INR 2-3)</td>
</tr>
<tr>
<td>Major trauma, SCI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High VTE risk plus high bleeding risk</td>
<td></td>
<td>Mechanical thromboprophylaxis§</td>
</tr>
</tbody>
</table>

*The descriptive terms are purposely left undefined to allow individual clinician interpretation.

†Rates based on objective diagnostic screening for asymptomatic DVT in patients not receiving thromboprophylaxis.

§Mechanical thromboprophylaxis includes IPC or VFP and/or GCS; consider switch to anticoagulant thromboprophylaxis when high bleeding risk decreases.

Geerts CHEST 2008;133:381S-453S
ACCP General Recommendations

• Mechanical methods be used primarily in patients who are at high risk of bleeding (grade 1C+) or as an adjunct to anticoagulant based prophylaxis (Grade 2A). Careful attention directed towards ensuring proper use/optional compliance (Grade 1C+)

• Aspirin is not recommended as prophylaxis against VTE for any patient group (Grade 1A)

Geerts CHEST 2004; 126(3) Supplement: 3385-4005
Advantages and Limitations of Mechanical Thromboprophylaxis Modalities

**Advantages**

- Do not increase the risk of bleeding
- Can be used in patients at high bleeding risk
- Efficacy has been demonstrated in a number of patient groups
- May enhance the effectiveness of anticoagulant thromboprophylaxis
- May reduce leg swelling

**Limitations**

- Not as intensively studied as pharmacologic thromboprophylaxis (fewer studies and smaller)
- No established standards for size, pressure, or physiologic features
- Many specific mechanical devices have never been assessed in any clinical trial
Advantages and Limitations of Mechanical Thromboprophylaxis Modalities (Continue)

**Limitations - continued**

- Almost all mechanical thromboprophylaxis trials were unblinded and therefore have a potential for bias
- In high-risk groups are less effective than anticoagulant thromboprophylaxis
- Greater effect in reduction calf DVT than proximal DVT
- Effect on PE and death unknown
- May reduce or delay the use of more effective anticoagulant thromboprophylaxis
- Compliance by patients and staff often poor
- Trials may overestimate the protection compared with routine use
- Cost: associated with purchase, storage, dispensing, and cleaning of the devices, as well as ensuring optimal compliance
Preliminary report on Post-Operative Treatment with Heparin as a Preventive of Thrombosis.¹

By

CLARENCE CRAFOORD.

I. Submitted for publication February 1936.

The author and Dr. JORPES, of the Chemical Department of the Karolinska Institutet, Stockholm, had already discussed in 1929 the possibility of preventing post-operative thrombosis by means of treatment with Heparin. The natural anti-coagulant Heparin, discovered by HOWELL in 1918, is certainly to be regarded as a suitable experimental medium for counteracting a tendency to thrombosis after an operation. At the time, however, Dr. JORPES considered that any kind of experiment on those lines was inadvisable, as no preparation was available that was sufficiently pure to be utilized without complicating reactions; this being so, the idea of employing this method of treatment was abandoned.
HEPARIN AND THROMBOSIS

THE PRESENT SITUATION

D. W. G. MURRAY, M.D.
AND
C. H. BEST, M.D.

TORONTO, CANADA

The anticoagulant heparin, discovered by Howell and Holt in 1916, has recently been shown to be effective in the prevention of thrombosis of veins produced by various means in experimental animals.¹ When the
PREVENTION OF VENOUS THROMBOSIS AND PULMONARY EMBOLISM IN INJURED PATIENTS

A Trial of Anticoagulant Prophylaxis with Phenindione in Middle-aged and Elderly Patients with Fractured Necks of Femur

S. SEVITT
M.D., M.Sc. Dubl., F.R.C.P.I., D.P.H.
CONSULTANT PATHOLOGIST
N. G. GALLAGHER *
M.B. N.U.I.
REGISTRAR IN PATHOLOGY
BIRMINGHAM ACCIDENT HOSPITAL

This paper is concerned with a controlled prophylactic trial of an anticoagulant in a group of patients susceptible to venous thrombosis and pulmonary embolism. The drug, phenindione (phenylindanedione), given in effective dosage under laboratory control, prevented these complications and the prophylaxis proved practicable and safe.

Such prophylaxis in injured patients has two main bases (see Sevitt 1959):

1. Pulmonary embolism is a relatively common cause of illness and death, particularly in those older than 50 years, confined to bed for more than a few days. It was found in about 20% of necropsies in the Birmingham Accident Hospital; it was the cause of death in 14%, and in 40–50% of elderly patients who died after a fractured femur, tibia, or pelvis.

2. Pulmonary embolism may also strike too soon after the clinical onset of thrombosis for anticoagulant therapy to be possible or effective.

Anticoagulant Prophylaxis

It is therefore important to know whether prophylaxis with anticoagulant drugs can prevent deep-vein thrombosis and hence embolism. Prophylaxis involves giving a drug to a large number of patients to prevent venous thrombosis in all and hence the risk of thrombus detachment and embolism.

Heparin was used as a prophylactic agent and was found of great value (Murray and Best 1938, Bauer 1941, 1946, Crafoord 1941, Jorpes 1941, Wetterdall 1941), but enthusiasm was abated by the expense of the drug and the tedium of its administration. Later dicoumarol became available and was used either with or without a preliminary course of heparin (Lehmann 1943, Barker et al. 1945, Bruzelius 1945, Murray 1947, Wise et al. 1949, Baker et al. 1950, McCann 1950, Kistner and Smith 1954, Insinger 1957). These trials were not specially concerned with injured patients and were generally related to the prevention of thromboembolic incidents after major surgery or in medical cases. They were all essentially clinical in approach, noting the incidence of diagnosed venous thrombosis and pulmonary embolism in the series. Often the incidence was compared with the results of previous years and not with that of a concurrent untreated series. The patients in each series varied widely in their ages, clinical diagnoses, and activity, and no doubt in their liability to thrombosis and embolism. Thus none of the reports can be considered as a controlled trial. Neither mortality-rates nor causes of death were reported, and only 3–4% incidence of venous thrombosis and pulmonary embolism were noted.

Sevitt Lancet 1959; 2: 982-985
### International Multicentre Trial

- **4121 patients, > 40 years old, elective major surgery**

### Deaths Autopsy
- **Massive PE**
  - Heparin Group: 2
  - Control Group: 16
  - Significance: $P < 0.005$
- **VTE Contributory**
  - Heparin Group: 3
  - Control Group: 6
  - Significance: $P < 0.005$

### Fibrinogen Uptake
- **7.7%**
- **24.6%**
- Significance: $P < 0.005$

### DVT
- **7.7%**
- **24.6%**

### Bleeding
- **Fatal**
  - Heparin Group: 4
  - Control Group: 5
  - Significance: $P = 0.34$
- **transfusion**
  - Heparin Group: 1316 ml
  - Control Group: 1285 ml
  - Significance: $P = 0.24$
- **↓ Hgb**
- **wound hematoma**

*Lancet 1975; 2: 45-51*
<table>
<thead>
<tr>
<th>Event</th>
<th>Control</th>
<th>Heparin</th>
<th>OR</th>
<th>% ↓</th>
<th>NNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>DVT</td>
<td>22%</td>
<td>9%</td>
<td>0.3</td>
<td>67%</td>
<td>7</td>
</tr>
<tr>
<td>Symptomatic PE</td>
<td>2%</td>
<td>1.3%</td>
<td>0.5</td>
<td>47%</td>
<td>143</td>
</tr>
<tr>
<td>Fatal PE</td>
<td>0.8%</td>
<td>0.3%</td>
<td>0.4</td>
<td>64%</td>
<td>182</td>
</tr>
<tr>
<td>All Cause Mortality</td>
<td>4.2%</td>
<td>3.2%</td>
<td>0.8</td>
<td>-</td>
<td>97</td>
</tr>
<tr>
<td>Bleeding</td>
<td>3.8%</td>
<td>5.9%</td>
<td>1.6</td>
<td>65%</td>
<td>NNH 47</td>
</tr>
</tbody>
</table>

Collins NEJM 1988; 318: 1162-1173
Collins NEJM 1988; 318: 1162-1173
Control: 60.5% (Relative risk reduction 67%)
Heparin: 20.3% (Relative risk reduction 68%)

Screening DVT: 60.5% vs. 20.3%
Fatal PE: 1.9% vs. 0.6%

Collins NEJM 1988; 318:1162-73
21% of patients in the Placebo group had venographic DVT, compared to 8.2% in the LMWH group, with a p < 0.001. In the symptomatic VTE category, 4.5% of Placebo patients vs. 1.7% of LMWH patients had cases, with a p < 0.01. (Cohen Thrombosis Haemostasis 2001; 85:940-1)
Venographic DVT

- Placebo: 33%
- Arixtra: 1.40%
- Relative risk reduction 96%
- \( p = 4 \times 10^{-22} \)

Symptomatic PE

- Placebo: 2.70%
- Arixtra: 0.30%
- Relative risk reduction 89%
- \( p = 0.021 \)

Erikkson Arch Int Med 2001; 135:858-69
DVT Free Registry Prophylaxis (# 5451)

71% No Prophylaxis (3894)

- 74% surgical patients with DVT did **NOT** receive prophylaxis (1559/2094)
- 68% Non-surgical patients with DVT did **NOT** receive prophylaxis (2295/3357)

29% Prophylaxis (1557)

- Pharmacologic 60% (931)
  - UFH 38% (350)
  - LMWH 26% (241)
- Mechanical 20% (309)
- Combo above 20% (313)
- DVT 4x common UFH (inpatients 36% vs 9%)

Goldhaber Am J Card 2004; 93:259-62
Rationale for Thromboprophylaxis in Hospitalized Patients

High prevalence of VTE

- Almost all hospitalized patients have one or more risk factors for VTE
- DVT is common in many hospitalized patient groups
- Hospital-acquired DVT and PE are usually clinically silent
- It is difficult to predict which at-risk patients will develop symptomatic thromboembolic complications
- Screening at-risk patients using physical examination or noninvasive testing is neither cost-effective nor effective

Adverse consequences of unprevented VTE

- Symptomatic DVT and PE
- Fatal PE
- Costs of investigating symptomatic patients
- Risks and costs of treating unprevented VTE
- Increased future risk of recurrent VTE
- Chronic postthrombotic syndrome

Geerts CHEST 2008;133:381S-453S
Rationale for Thromboprophylaxis in Hospitalized Patients continue

Efficacy and effectiveness of thromboprophylaxis

Thromboprophylaxis is highly efficacious at preventing DVT and proximal DVT

Thromboprophylaxis is highly effective at preventing symptomatic DVT and fatal PE

The prevention of DVT also prevents PE

Cost-effectiveness of thromboprophylaxis has repeatedly been demonstrated

Geerts CHEST 2008;133:381S-453S
Rationale for Prophylaxis
High Prevalence of VTE

- Most hospitalized patients have risk factors for VTE
- DVT is common in many hospitalized patient groups
- Hospital-acquired DVT and PE are usually clinically silent
- Difficult to predict which at-risk patients will develop symptomatic thromboembolitis complications
- Screening at-risk patients using physical examination or non-invasive testing is neither effective nor cost-effective

Geerts CHEST 126(3); Supplement: 338S-400S
Rationale for Prophylaxis
Adverse Consequences of Unprevented VTE

- Symptomatic DVT and PE
- Fatal PE
- Costs of investigating symptomatic patients
- Risks and costs of treating unprevented VTE, especially bleeding
- Increased future risk of recurrent VTE
- Chronic post-thrombotic syndrome

Geerts CHEST 126(3); Supplement: 338S-400S
Rationale for Prophylaxis
Efficacy and Effectiveness of Thromboprophylaxis

• Thromboprophylaxis is highly efficacious at preventing DVT and proximal DVT

• Thromboprophylaxis is highly effective at preventing symptomatic VTE and fatal PE

• The prevention of DVT also prevents PE

• Cost-effectiveness of prophylaxis had repeatedly been demonstrated

Geerts CHEST 126(3); Supplement: 338S-400S
### Clinical Model for Predicting Pretest Probability of DVT

#### Clinical Features

<table>
<thead>
<tr>
<th>Clinical Features</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>History</strong></td>
<td></td>
</tr>
<tr>
<td>Active cancer (ongoing treatment or within previous 6 months of palliative)</td>
<td>1</td>
</tr>
<tr>
<td>Paralysis, paresis, or recent plaster cast immobilization of the lower extremity</td>
<td>1</td>
</tr>
<tr>
<td>Recent bedrest &gt; 3 days or major surgery past 4 weeks</td>
<td>1</td>
</tr>
<tr>
<td><strong>Physical Examination</strong></td>
<td></td>
</tr>
<tr>
<td>Localized tenderness along deep venous distribution</td>
<td>1</td>
</tr>
<tr>
<td>Entire leg swollen</td>
<td>1</td>
</tr>
<tr>
<td>Calf swelling 3 cm &gt; contralateral side (measured 10 cm below tibial tuberosity)</td>
<td>1</td>
</tr>
<tr>
<td>Pitting edema confined to symptomatic leg</td>
<td>1</td>
</tr>
<tr>
<td>Dilated superficial vein(s)</td>
<td>1</td>
</tr>
<tr>
<td><strong>Alternative Diagnosis</strong></td>
<td></td>
</tr>
<tr>
<td>Alternative diagnosis as likely or more likely than DVT</td>
<td>-2</td>
</tr>
</tbody>
</table>

#### Pretest Probability

<table>
<thead>
<tr>
<th>Sum of scores</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 0</td>
<td>low probability</td>
</tr>
<tr>
<td>1 or 2</td>
<td>moderate probability</td>
</tr>
<tr>
<td>≥ 3</td>
<td>high probability</td>
</tr>
</tbody>
</table>
Approach to Suspected DVT (Outpatient)

Clinical Assessment of Pretest Probability

Low clinical probability
- D-dimer
  - Negative, DVT excluded
  - Positive, DUS
    - Negative, DVT excluded
    - Positive, DUS
      - Positive, DVT diagnosed
      - Negative, Repeat DUS in 3-5 days or MRI-venogram

Moderate/high clinical probability
- DUS
  - Positive, DVT diagnosed
  - Negative, D-dimer
    - Positive, DVT diagnosed
    - Negative, Repeat DUS in 3-5 days or MRI-venogram

DUS = Doppler Ultrasound
NEW ENGLAND SURGICAL SOCIETY

THROMBOSIS OF THE DEEP VEINS OF THE LOWER LEG, CAUSING PULMONARY EMBOLISM

BY JOHN HOMANS, M.D.†

There is a dangerous form of venous thrombosis, uncommon enough to make its study difficult, yet so often fatal as to make its recognition a matter of importance, the more so as, in its early stages, it is usually recognizable and probably curable. Any one individual’s experience is so limited as to make generalizations hazardous, and it is conceivable that many of you will recognize the disorder to which I refer as something far less serious than I have found it. Yet of the four patients who have suffered from the disease in question, two have died of pulmonary embolism, one has recovered after ligation of the femoral vein in the thigh and the fourth, without other treatment than rest in bed.

Actually unobstructed and the cause of the fatality was the detachment of a considerable fragment of an enormously long, insecure thrombus which had been waving, as it were, in the current. Possibly, if the patients had lived longer, the thrombosing process might solidly have filled the femoral and iliac veins, and then there would finally have been presented the picture of phlegmasia alba dolens. The fact is, however, that in the course of some weeks, even months in these two instances, no such thing occurred—the long clot broke off first. Doubtless there is more than one explanation why the disease acts in this way. The hypothesis which I will offer presently is reasonable enough, however, to fix in your minds the difference between other sorts of thrombophlebitis and this fatal form.
## Diagnostic Strategies for Excluding Pulmonary Embolism with Upper 95% Confidence Limit of 3% or less and 3 month risk

### Initial Evaluation

<table>
<thead>
<tr>
<th>Diagnostic Strategy</th>
<th>3-month risk for VTE complications (upper 95% CL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal pulmonary angiogram</td>
<td>0.8 (2.1)</td>
</tr>
<tr>
<td>Normal lung scan</td>
<td>0.9 (2.3)</td>
</tr>
<tr>
<td>Normal lung scan normal legs</td>
<td>0.6 (1.2)</td>
</tr>
<tr>
<td>Normal D-dimer</td>
<td>0.0 (1.8)</td>
</tr>
<tr>
<td>Normal D-dimer low clinical probability</td>
<td>0.2 (0.8)</td>
</tr>
</tbody>
</table>

Diagnostic Strategies Excluding Pulmonary Embolism

- **Initial round of diagnostic studies**
  - Normal
    - Pulmonary angio
    - Lung scintigraphy
    - ? Spiral CT
  - Or
    - Normal D-dimer
    - And
    - Low Clinical Probability

- **Second round of diagnostic studies**
  - Non-diagnostic lung scan
    - Or
      - Pulmonary Angio
      - Serial leg testing DVT
  - Or
    - Inconclusive D-dimer/clinical probability
      - Normal perfusion scan

Estimating Pre-test Probability of PE

- **Implicit (empiric)**
  - Uses clinician knowledge and experience
  - Frequent disagreement
  - Experience level influences assessment
  - Estimates trend towards middle → few low or high probability groups
  - Inaccurate low risk assessment

- **Explicit Criteria**
  - Scoring systems
  - Prediction rules
  - Clinical decision rules
### Canadian Score for Pre-test Probability

#### Creating the score

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspected DVT</td>
<td>3.0</td>
</tr>
<tr>
<td>An alternative diagnosis is less likely than PE</td>
<td>3.0</td>
</tr>
<tr>
<td>Heart rate &gt; 100 beats/min</td>
<td>1.5</td>
</tr>
<tr>
<td>Immobilization or surgery in the previous 4 wk</td>
<td>1.5</td>
</tr>
<tr>
<td>Previous DVT/PE</td>
<td>1.5</td>
</tr>
<tr>
<td>Hemoptysis</td>
<td>1.0</td>
</tr>
<tr>
<td>Malignancy (on treatment, treated in the past 6 mo, or palliative)</td>
<td>1.0</td>
</tr>
</tbody>
</table>

#### Interpretation of the score

<table>
<thead>
<tr>
<th>Score range</th>
<th>Mean probability of PE, %</th>
<th>Patients with this score, %</th>
<th>Interpretation of risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2 points</td>
<td>3.6</td>
<td>40</td>
<td>Low</td>
</tr>
<tr>
<td>3-6 points</td>
<td>20.5</td>
<td>53</td>
<td>Moderate</td>
</tr>
<tr>
<td>&gt;6 points</td>
<td>66.7</td>
<td>7</td>
<td>High</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age 60-79 years</td>
<td>1</td>
</tr>
<tr>
<td>Age &gt; 79 years</td>
<td>2</td>
</tr>
<tr>
<td>Prior DVT/PE</td>
<td>2</td>
</tr>
<tr>
<td>Recent surgery</td>
<td>3</td>
</tr>
<tr>
<td>Heart rate &gt; 100 beats/min</td>
<td>1</td>
</tr>
<tr>
<td>( \text{PaCO}_2 ), mmHg</td>
<td></td>
</tr>
<tr>
<td>(&lt;36)</td>
<td>2</td>
</tr>
<tr>
<td>36-39</td>
<td>1</td>
</tr>
<tr>
<td>( \text{PaO}_2 ), mmHg</td>
<td></td>
</tr>
<tr>
<td>(&lt;49)</td>
<td>4</td>
</tr>
<tr>
<td>49-60</td>
<td>3</td>
</tr>
<tr>
<td>(&gt;60)</td>
<td>2</td>
</tr>
<tr>
<td>(&gt;71)</td>
<td>1</td>
</tr>
<tr>
<td>Chest radiograph</td>
<td></td>
</tr>
<tr>
<td>Platelike atelectasis</td>
<td>1</td>
</tr>
<tr>
<td>Elevation of hemidiaphragm</td>
<td>1</td>
</tr>
</tbody>
</table>

### Interpretation of the score

<table>
<thead>
<tr>
<th>Score range</th>
<th>Mean probability of PE, %</th>
<th>Patients with this score, %</th>
<th>Interpretation of risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4 points</td>
<td>10</td>
<td>49</td>
<td>Low</td>
</tr>
<tr>
<td>5-8 points</td>
<td>38</td>
<td>44</td>
<td>Moderate</td>
</tr>
<tr>
<td>9-12 points</td>
<td>81</td>
<td>6</td>
<td>High</td>
</tr>
</tbody>
</table>

Clinical Gestalt vs Prediction Rules

<table>
<thead>
<tr>
<th>Pretest Prob</th>
<th>Rate Pulmonary Embolism (Clinical Gestalt)</th>
<th>Rate Pulmonary Embolism (Prediction Rules)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>8% - 19%</td>
<td>3% - 28%</td>
</tr>
<tr>
<td>Moderate</td>
<td>26% - 47%</td>
<td>16% - 46%</td>
</tr>
<tr>
<td>High</td>
<td>46% - 91%</td>
<td>38% - 98%</td>
</tr>
</tbody>
</table>

“Clinical gestalt of experienced clinicians and prediction rules used by physicians of varying experience have shown similar accuracy in discriminating among patients who have a low, moderate or high pretest probability of PE”

Chandilal JAMA 2003; 290: 2849 - 2858
Thrombosis Following Leg Injuries.

By

GUNNAR BAUER.

Every surgeon whose work has brought him into contact with fractures in the lower extremities has long been aware of the fact that these patients are especially subject to thrombo-embolic complications. It is, for instance, well known that a fatal pulmonary embolism often develops after fracture of the femoral neck or intraarticular fracture of the knee. The actual rate of incidence of these thrombotic manifestations, however, and the mortality and subsequent discomforts resulting from them, have not yet been studied in any detail.
Table 1.

Incidence of thrombosis and mortality following thrombosis in different groups of patients.

<table>
<thead>
<tr>
<th></th>
<th>Incidence of thrombosis</th>
<th>Death rate from pulmonary embolism among thrombosis cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>After surgical operations</td>
<td>1.61 %</td>
<td>16.6 %</td>
</tr>
<tr>
<td>After childbirth</td>
<td>1.01 %</td>
<td>3.6 %</td>
</tr>
<tr>
<td>Among internal patients</td>
<td>2.1 %</td>
<td>19 %</td>
</tr>
</tbody>
</table>
Bauer Acta Chir Scand 1944; 90: 229-248
ANTICOAGULANT DRUGS IN THE TREATMENT OF PULMONARY EMBOLISM
A CONTROLLED TRIAL

D. W. BARRITT
M.D. Lond., M.R.C.P.

S. C. JORDAN
M.B. Brist.

From the Departments of Medicine and Cardiology,
United Bristol Hospitals

The use of an anticoagulant drug in treating venous thrombosis was first reported by Murray et al. (1937) and Crafoord (1937), who administered heparin, and soon there were claims that the number of deaths from pulmonary embolism was thereby reduced.
Treatment of Pulmonary Embolism

- Treatment recommendations (Grade 1A)
  - SC LMWH
  - IV UFH
  - Monitored SC UFH
  - Fixed dose SC UFH
  - SC fondaparinux
- Routine assessment for thrombolytic therapy (1A)
- Treatment awaiting confirmation if high risk (1A)
- Initial treatment LMWH, UFH, fondaparinux for at least 5 days and until INR ≥ 2.0 for at least 24 hours (1A)
Treatment of Pulmonary Embolism

- Initiation of VKA with LMWH, UFH or fondaparinux first day treatment (1A)
- IV UFH
  - Initial 80 u/kg or 5000 u → cts infusion initial 18 u/kg/hr or 1300 u/hr to achieve APTT corresponding to heparin level 0.3-0.7 IU/ml anti-Xa activity (1A)
  - Monitored SC UFH → initial 17,500 u or weight adjusted dose 250 u/kg with adjustment to achieve plasma heparin level 0.3-0.7 (measured) 6 hours after injection (1C)
  - Fixed dose SC UFH → initial dose 333 u/kg followed by twice daily of 250 u/kg (1C)
Treatment of Pulmonary Embolism

- Non-Massive PE
  - SC LMWH > UFH (IC)
- Massive PE (Hemodynamically unstable) or consideration towards thrombolytics
  - IV UFH > SC LMWH (1A)
- Recommend against routine monitoring of anti-Xa levels with LMWH (1A)
- Renal failure → UFH > LMWH (2C)

ACCP Chest 2008; 133: 454S-545S
Systems and Local Thrombolytics

- An patients rapid risk stratification (1A)
  - Hemodynamically unstable → thrombolysis (1B)
  - Select high risk patients without hypotension and low risk of bleeding (2B)
    - Assessment of Severity
    - Prognosis
    - Bleeding risk
- Administered via peripheral vein (1B)
- Short infusion time 2 hr > 24 hr (1B)

ACCP Chest 2008; 133: 454S-545S
Long Term Treatment of Acute PE

- Transient reversible risk factor → 3 months (1A)
- Unprovoked PE → 3 month (1A)
  - Eval risk benefit for long term anti-coag (1A)
  - Low bleed risk/good monitoring → long term (1A)
- Second episode unprovoked → long term (1A)

ACCP Chest 2008; 133: 454S-545S
Long Term Treatment Acute PE

• PE and Cancer
  • 1st 3-6 months → LMWH (1A)
  • Subsequent LMWH/VKA indefinitely or until cancer resolves (1A)
• INR goal 2.5 (2.0 – 3.0) (1A)
  • Unprovoked PE patients strong preference for less INR monitoring → low intensity (1.5 – 1.9) > stopping anti-coagulation (1A)
• Recommend against high intensity INR (3.1 – 4.0) (1A)
• Unexpected finding of asymptomatic PE → same initial and long term anti-coagulation (1C)

ACCP Chest 2008; 133: 454S-545S
Driving Forces Behind Improvement Initiatives

- The Joint Commission (TJC)
  - National Patient Safety Goal (NPSG) 3.05.01
  - Performance Measures
- National Quality Forum (NQF)
  - Safe Practices 28 & 29
- Surgical Care Improvement Project (SCIP)
- UWHC 2010 Dashboard Goals
Purpose of Joint Commission’s NPSG

• Promote improvements in patient safety to prevent medical errors

• Highlight problematic areas in health care and describe evidence and expert-based solutions

• Focus on system-wide solutions

http://www.jointcommission/patientsafety/nationalpatientsafetygoals
Preventing errors relating to commonly used anticoagulants

Reports of accidental deaths and overdosing due to the improper use of anticoagulant drugs have received significant public attention. Anticoagulants have been identified as one of the top five drug types associated with patient safety incidents in the United States. In the United Kingdom, anticoagulants are one of the classes of drugs commonly associated with fatal medication errors. 
TJC NPSG 3.05.01
NQF Safe Practice 29

• Requirement:
  • Reduce patient harm associated with anticoagulation therapy

• Rationale
  • High risk, ADE, and poor standardization

• As of January 1, 2009 full implementation was expected

http://www.jointcommission/patientsafety/nationalpatientsafteygoals
Reducing Harm From Anticoagulants

• Implement a defined anticoagulant management program
  • January 2009: Anticoagulation Management Stewardship Program
  • March 2009: Anticoagulation Task Force
  • Physicians, nursing, pharmacy, laboratory, dietary, etc representatives

http://www.jointcommission/patientsafety/nationalpatientsafetygoals
Reducing Harm From Anticoagulants

• Develop protocols for initiation and maintenance of anticoagulation therapy

• Develop a written policy that addresses baseline and ongoing laboratory monitoring for UFH and LMWH

• Baseline INR available on all warfarin patients and current INRs used to monitor and adjust warfarin dose

http://www.jointcommission/patientsafety/nationalpatientsafetygoals
Anticoagulation Protocols

• Ambulatory Warfarin Guideline and Protocol
  • Approved by P&T October 2009

• Inpatient Warfarin Guideline and Protocol
  • Approved by the Task Force November 2009
  • Awaiting P&T approval

• Heparin Infusion Guideline and Protocol
  • Approved by P&T January 2004

• UFH/LMWH Dosing & Monitoring Guideline
  • Awaiting approval
INR Definitions

• Baseline INR
  • Ambulatory: within 30 days
  • Inpatient: Pre-OP: within 30 days
    Non-Surgical: within 24 hours

• Current INR
  • Ambulatory: within 24 hours
  • Inpatient: resulted within the same calendar day of scheduled warfarin dose
Reducing Harm From Anticoagulants

• Establish food/drug interaction program
• Provide patient education
  • Follow-up and Monitoring
  • Compliance
  • Drug/Food Interactions
  • Adverse drug reactions
• Provide education to staff

http://www.jointcommission/patientsafety/nationalpatientsafetygoals
Food/Drug Interaction Program

- Dietary services monitors patients receiving warfarin and provides education
- No “high” vitamin K foods available for patients to order
- Warfarin order set in development which will include nutrition consult
Patient Education

- Health Facts For You
  - #6900: Warfarin
  - #6915: UFH & LMWH
  - #322: How Diet Affects Warfarin
Reducing Harm From Anticoagulants

• Evaluate anticoagulation safe practices
  • Baseline data for ambulatory warfarin patients

• Implementation of a new anticoagulation tool for UWHC clinics

• Baseline data for inpatient warfarin and heparin patients

http://www.jointcommission/patientsafety/nationalpatientsafetygoals
Document VTE risk assessment in the medical record

Documentation of VTE risk/prophylaxis within 24 hours of hospital admission

Documentation of VTE risk/prophylaxis within 24 hours of ICU transfer

http://www.jointcommission.org/performancemeasures
http://www.qualityforum.org
Documenting Assessment and Prophylaxis

- Required section for admission, post operative, and transfer order sets
- Pharmacologic option reflects the highest level of evidence for disease state

Deep Vein Thrombosis Prophylactic Measures — Required

- DVT Prophylaxis — Required
  - Sequential Compression Device/Anti-Embolism Stockings
    - CONTINUOUS, Starting 6/17/09
  - DVT Prophylaxis - Reason Not Ordered
    - ONCE, Starting 6/17/09
  - heparin 5000 units/0.5 mL injection
    - 5,000 Units, Subcutaneous, EVERY 8 HOURS
Documenting Assessment and Prophylaxis

- If no indication for DVT prophylaxis, must state the indication
VTE Performance Measures & Safe Practice 28

- Adopt evidence based VTE protocols
- UFH dose and platelet count monitored by protocol
- Overlap of parenteral and warfarin anticoagulation of at least 5 days

http://www.jointcommission.org/performancemeasures
http://www.qualityforum.org
Evidence Based VTE Protocols

- Heparin Infusion Protocol
  - Approved by P&T January 2004
- UFH/LMWH guidelines
  - Awaiting approval
- Algorithms diagnosis of DVT and PE
VTE Performance Measures & Safe Practice 28

- Patient/Caregiver discharge instructions/education on VTE
- Provider education on VTE
- Document ongoing quality improvements
- Track incidence of potentially preventable hospital acquired VTE

http://www.jointcommission.org/performancemeasures
http://www.qualityforum.org
Patient Education

• HFFY #6699: Deep Vein Thrombosis and Pulmonary Embolism Trauma

• Patient education title for DVT
Tracking VTE Incidence and Improvement

• Track the incidence of hospital-acquired VTE yearly
• Collecting data on current rates of prophylaxis
• VTE prophylaxis report

http://www.jointcommission.org/performance_measures
http://www.qualityforum.org
UWHC Hospital Acquired VTE Data

- UWHC FY 08: 110 new diagnoses
- Total excess LOS: 455 days
- Total excess cost: $1,689,109
VTE Prophylaxis Report

- Development of a report to help identify patients needing DVT prophylaxis interventions
- Pharmacist will screen patients admitted in the previous 24 hours
  - Intent to screen on daily basis
VTE Prophylaxis Report

• Categorized List to Pharmacist:
  1. “No indication” checked in order set
  2. Receiving both pharmacologic and mechanical prophylaxis
  3. Indication, no bleed risk and not receiving prophylaxis
  4. Indication, no bleed risk but on mechanical prophylaxis
  5. Indication with bleed risk but not on mechanical prophylaxis
SCIP Quality Improvement Initiative

• Goal: reduce surgical complications by 25% by 2010

• Targets:
  • Surgical site infection
  • Cardiac Events
  • Post-op pneumonia
  • VTE: prophylaxis rates

http://www.qualitynet.org
http://www.jointcommission.org/performancemeasures
SCIP Measures for VTE

- SCIP VTE-1: Recommend VTE prophylaxis during admission

- UWHC Results
  - 2008: 98%
  - Q109: 100%
  - Q209: 100%

http://www.qualitynet.org
http://www.jointcommission.org/performancemeasures
SCIP Measures for VTE

- SCIP VTE-2: Appropriate VTE prophylaxis received within 24 hours prior to surgical incision to 24 hours after surgery end time.

- UWHC Results
  - 2008: 97%
  - Q109: 100%
  - Q209: 100%
UWHC Dashboard Goals

• Committed to reaching top 10% of performance levels on National Hospital Quality Measures

• 2010 Dashboard goal for anticoagulation
  • Reduce complications of anticoagulation therapy by 10%
Initiative Goals

- Increase % of patients receiving the appropriate VTE prophylaxis
- Decrease incidence of VTE
- Improve patient outcomes by standardizing anticoagulation care
- Reduce complications from anticoagulants
Resources

• Additional information can be found:
  • U Connect: Drug Use Guidelines – Anticoagulation Treatment Information
  • www.uwhealth.org/anticoagulation