Measurement and Improvement of Quality of Cardiovascular Care

DR : DEHESTANI
Hospitals
For hospitals in the United States, measures of cardiovascular care mandated by the Joint Commission have recently become important foci for quality improvement. These measures are part of a program called the ORYX Initiative, which integrates outcomes and other performance measurement data into the accreditation process for hospitals. Two of the core foci of the ORYX initiative are acute myocardial infarction and heart failure. Comparisons of hospitals on these measures can be made on the Joint Commission website. Despite broad acceptance
<table>
<thead>
<tr>
<th>MEASURE</th>
<th>DESCRIPTION</th>
<th>MEAN PERFORMANCE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persistence of beta blocker treatment after a heart attack</td>
<td>Percentage of patients &gt;18 yr old who were hospitalized and discharged alive during measurement year with diagnosis of AMI and who received persistent beta blocker treatment for 6 mo after discharge.</td>
<td>71.9</td>
</tr>
<tr>
<td>Controlling high blood pressure</td>
<td>Percentage of patients 45-85 yr old with diagnosis of hypertension and whose blood pressure was adequately controlled (&lt;140/90 mm Hg) during measurement year.</td>
<td>62.2</td>
</tr>
<tr>
<td>Cholesterol screening and management</td>
<td>Percentage of patients 18-75 yr old who had evidence of an acute cardiovascular event (hospitalization for AMI, coronary artery bypass grafting, or percutaneous transluminal coronary angioplasty) and whose low-density lipoprotein cholesterol was measured.</td>
<td>58.7</td>
</tr>
</tbody>
</table>
Incidence

900,000 PEs/ DVTs in USA in 2002. Estimated 296,000 PE deaths:
  7% treated, 34% sudden and fatal, and 59% undetected.

762,000 PEs/ DVTs in EU in 2004.
Annual # At-Risk for VTE: US Hospitals

- 7.7 million Medical Service inpatients
- 3.4 million Surgical Service inpatients
- Based upon ACCP guidelines for VTE prophylaxis
VTE: A Major Source of Mortality and Morbidity

- 350,000 to 650,000 with VTE per year
- 100,000 to > 200,000 deaths per year
- Most are hospital related.
- VTE is primary cause of fatality in half-
  - More than HIV, Breast CA *combined*
  - Equals 1 jumbo jet crash / day
- 10% of hospital deaths
  - May be the #1 preventable cause
- Huge costs and morbidity (recurrence, post-thrombotic syndrome, chronic PAH)
Failure to Do Simple Things Well

- Wash Hands
  - 60% Reliable
- Patients Understand Meds / Problems
  - 40% Reliable
- Central Lines Placed w/ Proper Technique
  - 60% Reliable
- Basal Insulin for Inpt Uncontrolled DM
  - 40% Reliable
- VTE Prophylaxis
  - 50% Reliable
Registry Data

Highlight the Underuse of Thromboprophylaxis

DVT-FREE  RIETE  IMPROVE

BAD NEWS!
Only a minority of hospitalized patients receive thromboprophylaxis
• Out of ~70,000 patients in 358 hospitals, appropriate prophylaxis was administered in:
  – 58.5% of surgical patients
  – 39.5% of medical patients
Rationale for DVT Prevention

• Prevalence
  – Hospitalized patients have risk factors for VTE
  – DVT usually clinically silent, difficult to predict complications
  – Screening is neither effective nor cost-effective
• Adverse consequences
  – Symptomatic DVT and PE or Fatal PE
  – Costs of testing and treating
  – Increased future risk of recurrent VTE
• Efficacy and effectiveness of prophylaxis
  – Prophylaxis prevents DVT and PE
  – The prevention of DVT also prevents PE
  – Prophylaxis is cost-effective
Outpatient and Inpatient VTE are Linked

- 74% of VTEs present in outpatients.
- 42% of outpatient VTE patients have had recent surgery or hospitalization.
- Only 40% had received VTE prophylaxis.
ICOPER Cumulative Mortality

Mortality (%)

Days From Diagnosis

Mortality (%)

0
5
10
15
20
25

17.5%

Days From Diagnosis

0
7
14
30
90
# Cardiovascular Risk Factors and VTE

(N=63,552 meta-analysis)

<table>
<thead>
<tr>
<th>RF</th>
<th>RR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obesity</td>
<td>2.3</td>
</tr>
<tr>
<td>Hypertension</td>
<td>1.5</td>
</tr>
<tr>
<td>Diabetes</td>
<td>1.4</td>
</tr>
<tr>
<td>Cigarettes</td>
<td>1.2</td>
</tr>
<tr>
<td>High Cholesterol</td>
<td>1.2</td>
</tr>
</tbody>
</table>
RISK OF PE: BMI

Nurses' Health Study

JAMA 1997; 277: 642

RR
(95% CI)

< 21 21-23 23-25 25-29 > 29

BODY MASS INDEX (kg/m²)

* 3.0
1.7
1.2
0.7
1

*
**PE AND CIGARETTE SMOKING**

Nurses' Health Study

(JAMA 1997; 277: 642)

<table>
<thead>
<tr>
<th>Cigarette Smoking</th>
<th>RR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never Cigs (ref)</td>
<td>1</td>
</tr>
<tr>
<td>1-14 Cigs</td>
<td>0.8</td>
</tr>
<tr>
<td>15-24 Cigs</td>
<td>1.1</td>
</tr>
<tr>
<td>25-34 Cigs</td>
<td>1.8</td>
</tr>
<tr>
<td>≥ 35 Cigs</td>
<td>2.1</td>
</tr>
</tbody>
</table>

* indicates significance.
Worldwide Prophylaxis Status for 68,183 Patients

52% at Risk for VTE
(50% receive ACCP recommended prophy)

64% at Risk for VTE
59% receive ACCP Rec. Px

42% at Risk for VTE
40% receive ACCP Rec. Px

Surgical

Medical
Risk factors for DVT

• What are risk factors for DVT in hospitalized patients?
• What is Virchow’s Triad?
Virchow’s Triad

- Stasis
- Trauma
- Hypercoaguability

Risk Factors for DVT

• **Stasis**
  – Surgery, trauma, immobility, paresis
  – Increasing age
  – Pregnancy and postpartum
  – Heart or respiratory failure
  – Obesity

• **Vessel Injury**
  – Previous DVT
  – Smoking
  – Varicose veins
  – Central venous catheterization

• **Hypercoagulability**
  – Increasing age
  – Malignancy
  – Cancer therapy
  – Estrogen therapy
    • (OCP or HRT)
  – Acute medical illness
  – Inflammatory bowel disease
  – Nephrotic syndrome
  – Myeloproliferative disorders
  – Paroxysmal nocturnal hemoglobinuria
  – Inherited or acquired thrombophilia
Risk Factors for VTE

- Age
- Prior VTE
- Surgery, trauma
- Immobility
- Pregnancy/postpartum
- Medical illness
  - Cancer & cancer rx
  - Inflammatory Bowel Dz
  - Nephrotic Syndrome
  - Obesity
- CVL
- Meds
  - Hormone replacement
  - Tamoxifen, raloxifene
  - Cancer drugs
  - Erythropoetin
- Thrombophilia
  - Inherited
  - Acquired
<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active cancer(^a)</td>
<td>3</td>
</tr>
<tr>
<td>Previous VTE (with the exclusion of superficial vein thrombosis)</td>
<td>3</td>
</tr>
<tr>
<td>Reduced mobility(^b)</td>
<td>3</td>
</tr>
<tr>
<td>Already known thrombophilic condition(^c)</td>
<td>3</td>
</tr>
<tr>
<td>Recent ((\leq 1) mo) trauma and/or surgery</td>
<td>2</td>
</tr>
<tr>
<td>Elderly age ((\geq 70) y)</td>
<td>1</td>
</tr>
<tr>
<td>Heart and/or respiratory failure</td>
<td>1</td>
</tr>
<tr>
<td>Acute myocardial infarction or ischemic stroke</td>
<td>1</td>
</tr>
<tr>
<td>Acute infection and/or rheumatologic disorder</td>
<td>1</td>
</tr>
<tr>
<td>Obesity (BMI (\geq 30))</td>
<td>1</td>
</tr>
<tr>
<td>Ongoing hormonal treatment</td>
<td>1</td>
</tr>
</tbody>
</table>

In the Padua Prediction Score risk assessment model, high risk of VTE is defined by a cumulative score \(\geq 4\) points. In a prospective observational study of 1,180 medical inpatients, 60.3% of patients were low risk and 39.7% were high risk. Among patients who did not receive prophylaxis, VTE occurred in 11.0% of high-risk patients vs 0.3% of low-risk patients (HR, 32.0; 95% CI, 4.1-251.0). Among high-risk patients, the risk of DVT was 6.7%, nonfatal PE 3.9%, and fatal PE 0.4\(^\circ\).\(^9\) HR = hazard ratio.

\(^a\)Patients with local or distant metastases and/or in whom chemotherapy or radiotherapy had been performed in the previous 6 mo.

\(^b\)Anticipated bed rest with bathroom privileges (either because of patient’s limitations or on physician’s order) for at least 3 d.

\(^c\)Carriage of defects of antithrombin, protein C or S, factor V Leiden, G20210A prothrombin mutation, antiphospholipid syndrome.
Table 3—Independent Risk Factors for Bleeding in 10,866 Hospitalized Medical Patient\(^a\)

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Total Patients, No. (%) (N = 10,866)</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active gastroduodenal ulcer</td>
<td>236 (2.2)</td>
<td>4.15 (2.21-7.77)</td>
</tr>
<tr>
<td>Bleeding in 3 mo before admission</td>
<td>231 (2.2)</td>
<td>3.64 (2.21-5.99)</td>
</tr>
<tr>
<td>Platelet count &lt; 50 × 10(^9)/L</td>
<td>179 (1.7)</td>
<td>3.37 (1.84-6.18)</td>
</tr>
<tr>
<td>Age ≥ 85 y (vs &lt; 40 y)</td>
<td>1,178 (10.8)</td>
<td>2.96 (1.43-6.15)</td>
</tr>
<tr>
<td>Hepatic failure (INR &gt; 1.5)</td>
<td>219 (2.0)</td>
<td>2.18 (1.10-4.33)</td>
</tr>
<tr>
<td>Severe renal failure (GFR &lt; 30 mL/min/m(^2))</td>
<td>1,084 (11.0)</td>
<td>2.14 (1.44-3.20)</td>
</tr>
<tr>
<td>ICU or CCU admission</td>
<td>923 (8.5)</td>
<td>2.10 (1.42-3.10)</td>
</tr>
<tr>
<td>Central venous catheter</td>
<td>820 (7.5)</td>
<td>1.85 (1.18-2.90)</td>
</tr>
<tr>
<td>Rheumatic disease</td>
<td>740 (6.8)</td>
<td>1.78 (1.09-2.89)</td>
</tr>
<tr>
<td>Current cancer</td>
<td>1,166 (10.7)</td>
<td>1.78 (1.20-2.63)</td>
</tr>
<tr>
<td>Male sex</td>
<td>5,367 (49.4)</td>
<td>1.48 (1.10-1.99)</td>
</tr>
</tbody>
</table>

Data shown were obtained by multiple logistic regression analysis for characteristics at admission independently associated with in-hospital bleeding (major bleeding and clinically relevant nonmajor bleeding combined). GFR = glomerular filtration rate; INR = international normalized ratio.

\(^a\)Although not specifically studied in medical patients, one would also expect dual antiplatelet therapy to increase the risk of bleeding.
Risk Factors for VTE

- Age
- Prior VTE
- Surgery, trauma
- Immobility
- Pregnancy/postpartum
- Medical illness
  - Cancer & cancer rx
  - Inflammatory Bowel Dz
  - Nephrotic Syndrome
  - Obesity
- CVL
- Meds
  - Hormone replacement
  - Tamoxifen, raloxifene
  - Cancer drugs
  - Erythropoetin
- Thrombophilia
  - Inherited
  - Acquired

Almost all inpatients have 1 RF
40% of inpatients have ≥3 RF
# Absolute Risk of DVT in Hospitalized Patients

<table>
<thead>
<tr>
<th>Patient Group</th>
<th>DVT Prevalence, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical patients</td>
<td>10–20</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>

VTE Prophylaxis Guideline

**Risk of VTE**

**Low risk** if all 3:
- Younger than 40
- Mobile
- No thrombotic risk factors

**Moderate risk**: All other patients

**High risk**: ICU patients

**High Bleeding Risk**

- Active gastroduodenal bleed
- Bleeding within 3 months prior to admission
- Platelet count of < 50
## Risk Stratification

<table>
<thead>
<tr>
<th>Risk</th>
<th>Type</th>
<th>Rx</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Minor surgery &amp; medical, mobile</td>
<td>Early ambulation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>Most general surgery &amp; medical patients</td>
<td>Medical +/- mechanical</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>Ortho &amp; major trauma</td>
<td>Medical +/- mechanical</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
THANKS!
Literature Search

• Cochrane Collaboration
  – www.cochrane.org

• National Guideline Clearinghouse
  – www.guideline.gov

• Pub Med
Guidelines

- Prevention of venous thromboembolism: the Seventh ACCP Conference on Antithrombotic and Thrombolytic Therapy.
  - http://www.chestjournal.org/cgi/content/full/126/3_suppl/338S
- Institute for Clinical Systems Improvement (ICSI). Venous thromboembolism prophylaxis.
  - www.icsi.org
- NICE. Venous thromboembolism: reducing the risk of venous thromboembolism (deep vein thrombosis and pulmonary embolism) in inpatients undergoing surgery.
  - http://guidance.nice.org.uk/CG46
What outcomes do we look for?
Outcomes

- Asymptomatic DVT?
- Symptomatic DVT?
- PE?
  - Fatal
  - All PE’s?
- Long-term complications?
How can you prevent DVT?
Methods of DVT Prophylaxis

• Mobilization
• Graduated compression stockings
• Intermittent pneumatic compression
• Aspirin
• Unfractionated heparin
• Low-molecular weight heparins
  – Enoxaparin, dalteparin
• Vitamin K antagonists
  – Warfarin, acenocoumarol, phenindione, & dicoumarol
• Fondaparinux (Factor Xa inhibitor)
Mechanical prophylaxis

- Graduated Compression Stockings (GCS)
  
<table>
<thead>
<tr>
<th>Prophylaxis</th>
<th>DVT Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>27%</td>
</tr>
<tr>
<td>GCS</td>
<td>13%</td>
</tr>
<tr>
<td>“Background” Prophylaxis</td>
<td>15%</td>
</tr>
<tr>
<td>GCS + “Background”</td>
<td>2%</td>
</tr>
</tbody>
</table>

Mechanical prophylaxis

• Intermittent pneumatic compression (IPC)

<table>
<thead>
<tr>
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<th>DVT Rate</th>
</tr>
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<tbody>
<tr>
<td>None</td>
<td>29%</td>
</tr>
<tr>
<td>GCS</td>
<td>15%</td>
</tr>
<tr>
<td>IPC</td>
<td>8-11%</td>
</tr>
</tbody>
</table>

Mechanical prophylaxis

• Systematic review – surgical patients
  – GCS, IPCs as monotherapy
    • 2/3 reduction in DVT
  – GCS, IPCs added to pharmacotherapy
    • Additional 50% reduction in DVT
  – GCS, IPCs *may* reduce PE by 40%

Mechanical prophylaxis

• Other issues...
  – Not shown to reduce death
  – Use with caution in vascular insufficiency
Clinical Question

• A 70 male is going to be hospitalized for an inguinal hernia repair. He takes aspirin for vascular prophylaxis.
  – Should he stop ASA for surgery?
Aspirin – a low-risk measure?

- Small studies inconclusive
- PEP study (Lancet. 2000:1295-302)
  - 1700 hip surgery patients, f/u to 35 days
  - ASA vs Placebo
  - Fatal PE 0.3% vs 0.6%
  - Symptomatic DVT 0.9% vs 1.3%
  - Small risk increase in hematemesis and wound bleeding
- ACCP & ICSI
  - Recommend against relying on aspirin for DVT prevention
- SIGN
  - Advocates ASA for DVT prevention in surgical patients.
Clinical Question

• A 60 year old female is hospitalized for a COPD exacerbation.
  – Do you need to provide DVT prophylaxis?
  – What do you order?
General Medicine

• **LMWH and UFH**
  – Reduce DVT and PE by 56-58%
  – No effect demonstrated on death

• **LMWH vs UFH**
  – No difference in DVT or PE
  – Lower risk of major bleeding (by 52%)

General Medicine

• Recommendations
  – Ambulation for all patients
  – LMWH or UFH
    • For patients with HF, Respiratory disease, immobility PLUS other risk factors
  – Mechanical prophylaxis
    • If anti-coagulants contraindicated.
    • Consider for all bed-bound patients

– Chest 2004 Sep;126(3 Suppl):338S-400S.
– Institute for Clinical Systems Improvement (ICSI).
Non-Orthopedic Surgery

- General
- Gynecologic
- Colorectal
- Urologic
- Vascular
Clinical Question

A 45 year old male was hospitalized for gall bladder disease & his cholecystectomy had to be converted from laparoscopic to open.

– Does he need DVT prophylaxis?
– What would you use?
General Surgery

  - LMWH & UFH reduce DVT & PE risk
  - LMWH reduced minor bleeds 25%

  - LMWH & UFH reduced all DVT, reduced PE
  - Same bleeding risk

  - Confirmed LWMH and UFH equally effective & safe for DVT prevention
General Surgery

• ACCP, ICSI, SIGN
  – Low-risk pts (young, non-major surgery)
    • Early and persistent mobilization
  – Moderate-risk pts (major surgery OR > 40 yrs)
    • Use LMWH or UFH
  – High-risk pts (major surgery, > 40 yrs)
    • GCS, plus LMWH or UFH
  – Use GCS if risk of bleeding precludes anti-coagulants.

• NICE
  – Inpatients having surgery should be offered GCS from the time of admission to hospital unless contraindicated
Clinical Question

• A 70 year old woman with severe DJD and diabetes is having elective hysterectomy for significant uterine prolapse.
  – Do you recommend DVT prophylaxis?
  – What prophylaxis?
Major Gynecologic Surgery

• Cochrane:
  – UFH prevents DVT in women with malignancy
  – Warfarin prevents DVT in women w/o malignancy
  – LMWH – just as effective as UFH
  – No studies of ASA

ACOG Recommendations:

- Moderate or high risk patients
  - Major surgery, CA, other DVT risk factors
  - GCS or IPC
    - Apply intraoperatively, cont. till ambulatory
  - UFH
    - Start 2-8 hrs pre-op, continue till D/C
  - LMWH
    - Start 12 hrs pre-op, continue till D/C

Colorectal surgery

• Both LMWH and UFH reduce DVT risk
• Adding GCS to either method provides added protection

Other Non-Ortho Surgery

• Colorectal
  – Both LMWH and UFH reduce DVT risk
  – GCS provide added protection

• Urologic
  – Minimal evidence
  – UFH, LMWH, GCS, or IPC for pts w/ high DVT

• Vascular
  – Most are on anti-platelet agents anyway
  – Base prophylaxis on other risk factors
Clinical Question

• You are asked to provide medical consultation on a 75 year old nursing home patient with hypertension and heart disease who needs ORIF of a left hip fracture.
  – What DVT prophylaxis do you recommend?
Orthopedics

- LMWH better & safer than warfarin or UFH
  » Haemostasis. 1997 Mar-Apr;27(2):75-84.

- LMWH better & safer than warfarin or UFH for TKR

- LMWH or IPC better than ASA or warfarin for TKR
  » J Arthroplasty. 2001 Apr;16(3):293-300

- LMWH & UFH similarly effective after hip fx surgery

- LMWH better than Vit K antagonists in ortho surgery
Orthopedics

• No difference in DVT rates between:
  – Pre-op or post-op initiation of LMWH
  – Different currently-accepted LMWH doses

Orthopedic Guidelines

• ACCP and ICSI
  – Elective hip or knee arthroplasty
    • LMWH, vitamin K antagonists, fondaparinux
  – Hip fracture surgery
    • LMWH, vitamin K antagonists, fondaparinux, or UFH
    • Start LMWH or UFH at hospital admission if fracture repair will be delayed.

• NICE
  – Hip fracture or elective orthopedic surgery
    • LMWH/Fondaparinux + mechanical
Trauma

• High risk of DVT or PE
  – 40–80% DVT

• ACCP & SIGN
  – LMWH for prophylaxis
  – Mechanical prophylaxis if risk of bleeding precludes anticoagulants.

Key Messages

• Both GCS & IPCs significantly reduce DVT rates.
• UFH and LMWH equally effective and general surgery patients.
  – GCS can provide additional protection for high-risk patients.
• Use either GCS placed intraoperatively, or UFH or LMWH started preoperatively, gynecologic surgery at risk of DVT
  – Major surgery, malignancy, or other DVT risk factors.
• Use LMWH, vitamin K antagonists, or fondaparinux after elective major hip or knee surgery.
• For hip fracture
  – Start LMWH or UFH pre-op if delay until surgery
  – Post-operative DVT prophylaxis: LMWH, UFH, vitamin K antagonists, or fondaparinux.
Information for Patients


- Deep Vein Thrombosis (DVT). 
  http://www.patient.co.uk/showdoc/23068982/ (accessed 6 June 2007)

- CG46 Venous thromboembolism: Understanding NICE guidance. 