Thromboprophylaxis in Pediatrics
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Disclosure

• Dr. Moises Auron has no relevant financial relationships with the manufacturer(s) of any commercial product(s) and/or provider(s) of commercial services discussed in this CME activity
• Deallus consulting – Honoraria, blood management
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• McGrawHill Clinical Access – Pediatrics editor – honoraria
Objectives

• Recognize that VTE is a real and dangerous complication in hospitalized children.
• Discuss the risk factors for VTE and rationale for VTE prophylaxis
• Appraise the current tools for VTE risk stratification and prophylaxis
• Apply the clinical tools in different clinical scenarios

Is VTE a pediatric problem?

Tapson VF. NEJM. 2008;358:1037-52.
Epidemiology

- Estimated incidence ~ 0.07 to 0.49 per 10,000 children
- Hospitalized children ~ 4.9–21.9 per 10,000 hospital admissions
- 50% of VTE events occurring in age group 11–18 years old

• Incidence of VTE - 188/100,000 discharges
• Death: RR 6.27 (95% CI 5.41–7.25)

Table 1—Wells Scores for Predicting PTP of PE

<table>
<thead>
<tr>
<th>Wells</th>
<th>Points</th>
<th>Simplified Wells</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical signs of DVT</td>
<td>3.0</td>
<td>Clinical signs of DVT</td>
<td>1.0</td>
</tr>
<tr>
<td>Recent surgery or immobilization</td>
<td>1.5</td>
<td>Recent surgery or immobilization</td>
<td>1.0</td>
</tr>
<tr>
<td>Heart rate</td>
<td>1.5</td>
<td>Heart rate</td>
<td>1.0</td>
</tr>
<tr>
<td>&gt; 100 beats/min</td>
<td>1.5</td>
<td>&gt; 100 beats/min</td>
<td>1.0</td>
</tr>
<tr>
<td>Previous VTE</td>
<td>1.5</td>
<td>Previous VTE</td>
<td>1.0</td>
</tr>
<tr>
<td>Hemothysis</td>
<td>1.0</td>
<td>Hemothysis</td>
<td>1.0</td>
</tr>
<tr>
<td>Malignancy</td>
<td>1.0</td>
<td>Malignancy</td>
<td>1.0</td>
</tr>
<tr>
<td>Alternative diagnosis less likely than PE</td>
<td>3.0</td>
<td>Alternative diagnosis</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Wells score three-level: < 2 points, low; 2-6 points, intermediate; > 6 points, high. Wells score two-level: PE unlikely ≤ 4 points; PE likely > 4 points. Simplified Wells score: PE unlikely ≤ 1 point; PE likely > 1 point. PE = pulmonary embolism; PTP = pretest probability.

Risk Factors for Venous Thromboembolism

- positive blood stream infection
- central venous catheter
- direct admission to ICU/NICU
- hospitalization for ≥ 7 days
- immobilization for > 72 h
- use of birth control pills

Risk score > 3

- Sensitivity of 70%
- Specificity of 80%
- AUC 0.852 (95% CI 0.814-0.890).


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Perioperative thromboprophylaxis in children: development of a guideline for management

PHILIP C. JACKSON MBChB FRCA AND JUDITH M. MORGAN MBChB FRCA

Thromboprophylaxis in a Pediatric Hospital: A Patient-Safety and Quality-Improvement Initiative
Leslie Raffini, Tara Trimarchi, Johanna Béliceau and Daniela Davis
Pediatrics 2011;127:e1326; originally published online April 4, 2011

Guideline on the investigation, management and prevention of venous thrombosis in children

Elizabeth Chilvers,* Vinaya Gamage,* B J Linehan,* Sandie Monks,* Timothy Nokes,* D Sanders* and Michael Williams*
Royal Hospital for Sick Children, Glasgow; Great Ormond Street Hospital, London; Royal London Hospital, Thameham; and Birmingham Children's Hospital, Birmingham, UK

Venous Thromboembolism in Hospitalized Adolescents: An Approach to Risk Assessment and Prophylaxis

Algorithm for inpatient VTE risk assessment and prophylaxis: DVT indicates deep vein thrombosis; PE, pulmonary embolism; SQ, subcutaneous; BD, twice daily; UFH, unfractionated heparin.
Venous Thromboembolism in Hospitalized Adolescents: An Approach to Risk Assessment and Prophylaxis

**VTE Risk Factors**
- Blood stream infection
- Central Venous Catheter (including non-tunneled, tunneled and PICCs)
- History of venous thrombosis
- Hyperosmolar state (serum osmolality >320 mOsm/kg)
- Inflammatory diseases (e.g. IBD, SLE)
- Medications: asparaginase, estrogen use (within past 2 months)
- Obesity (BMI > 95th percentile for age)
- Oncologic diagnosis
- Orthopedic procedures: hip or knee reconstruction
- Nephrotic syndrome
- Thrombophilia - known, or family history of clots
- Trauma: >1 lower extremity long bone fracture, complex pelvic fractures, spinal cord injury


**Contraindications to Mechanical Prophylaxis**
- DVT, suspected or existing (can use GCS)
- Extremity to be used has acute fracture
- Extremity to be used has PIV access
- Skin conditions affecting extremity (e.g. dermatitis, burn)
- Unable to achieve correct fit due to patient size

**Contraindications to Anticoagulation**

<table>
<thead>
<tr>
<th>Absolute:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bleeding disorder, known or tendency</td>
</tr>
<tr>
<td>Hemorrhage, evidence of or high risk of</td>
</tr>
<tr>
<td>Platelet count unable to be sustained &gt; 50,000/mm³</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Relative:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intracranial mass</td>
</tr>
<tr>
<td>Lumbar puncture or epidural catheter removal in prior 12 hours</td>
</tr>
<tr>
<td>Neurosurgical procedure</td>
</tr>
<tr>
<td>Pelvic fracture within past 48 hours</td>
</tr>
<tr>
<td>Uncontrolled hypertension</td>
</tr>
</tbody>
</table>

• In children hospitalized after trauma who are at low risk of bleeding, we conditionally recommend pharmacologic prophylaxis be considered for those >15 y old and in younger post-pubertal children with ISS >25. We conditionally recommend against the use of routine pharmacologic prophylaxis in pre-pubertal children, even with ISS >25.

• In children hospitalized after trauma, we conditionally recommend mechanical prophylaxis be considered for those >15 y old and in younger post-pubertal children with ISS >25 versus no prophylaxis or in addition to pharmacologic prophylaxis.

• In children hospitalized after trauma, we conditionally recommend against active surveillance for VTE with ultrasound compared with daily physical examination alone for earlier detection of VTE.
CCCH VTE Prophylaxis Guideline

- Altered Mobility
- Chronic Medical Conditions
- Acute Medical Conditions
- Risk:
  - Medications
  - Obesity
  - Smoking
  - CVL
### Pediatric Venous Thromboembolism (VTE) Prevention Worksheet

(Ages 12 - 18 years)

If age < 12 years, then STOP

Consult pediatric hematology (page 25630) if VTE recommendations are desired

<table>
<thead>
<tr>
<th>Score (circle one)</th>
<th>(not present)</th>
<th>(present)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MRN:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assessment completed by:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Altered Mobility/Activity
- Spends time in bed most of the day, even with bathroom privileges

#### Chronic Medical Conditions (+1 if any present, regardless of number of conditions)
- Acquired / Inherited Thrombophilia
  - Antiphospholipid antibodies
  - Antithrombin deficiency
  - Prekallikrein gene mutation (K20211A)
  - Factor V Leiden
  - Hyperhomocysteinemia
  - Elevated Factor VIII activity

- Metabolic disorders
  - Carbohydrate deficient glycoprotein syndrome
  - Homocystinemia

- Nephrotic syndrome
- Inflammatory bowel disease (IBD)
- Congenital heart disease

#### Acute Medical Conditions (+1 if any present, regardless of number of conditions)
- Pelvic or lower extremity malignancy
- Nutritional insufficiency
- Active vasculitis / rheumatologic disease
  - Systemic lupus erythematosus (SLE)
  - Rheumatoid arthritis
  - Juvenile arthritis (JIA or JRA)
  - Behçet
  - Small/medium vessel vasculitis
  - Familial Mediterranean fever (FMF)
- Active infection
- Sepsis
- CNS infections
- Intraabdominal or thoracic abscess
- Bone/joint infections (osteomyelitis, septic arthritis)
- Endocarditis
- Complicated pneumonia (e.g., necrotizing or empyema)
- Major surgery / burn
- Spine
- Lower extremity
- Pelvic
### Medications (+1 for any)

<table>
<thead>
<tr>
<th>Condition</th>
<th>0</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral, intramuscular, or implantable contraceptive within past 30 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steroids, current high dose IV or oral &gt; 14 days within past 30 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parenteral nutrition (TPN or PPN)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asparaginase within last 30 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central venous access present</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obesity (BMI &gt; 95th percentile for age)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regular smoking within past 30 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pregnant</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total Score:** 0

### Pharmacological Guidelines

**Score = 0 - 1**  
Minimal risk  
Encourage ambulation

**Score = 2**  
Lower risk  
Intermittent pneumatic compression (IPC) device

**Score ≥ 3**  
Higher risk  
If score does not include immobility  
Pharmacological prophylaxis  
If score includes immobility  
Pharmacological prophylaxis + IPC device

**Enoxaparin (Lovenox)**

- **Weight < 60 kg**<br>0.5 mg/kg/dose SQ q 12 hours
- **Weight ≥ 60 kg**<br>40 mg SQ q 24 hours or 5000 units SQ q 12 hours

**Relative contraindications to pharmacological prophylaxis**

- Already receiving anticoagulation
- Active bleeding
- History of heparin-induced thrombocytopenia (HIT)
- Platelet count < 50,000
- Patient or guardian refusal
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Ciara

- 17 y/o, healthy, not taking medications, non-smoker, not sexually active, not pregnant, BMI 22. Squad leader lacrosse team.
- Admitted for post-traumatic elbow bursitis with infection requiring drainage and IV antibiotics.
- What is her risk score?
  a) 1
  b) 2
  c) 3
  d) 4
  e) 5
17 y/o, healthy, not taking medications, non-smoker, not sexually active, not pregnant, BMI 22. Squad leader lacrosse team. Admitted for post-traumatic elbow bursitis with infection requiring drainage and IV antibiotics. What is her risk score?

- 1: 0%
- 2: 0%
- 3: 0%
- 4: 0%
- 5: 0%

Ciara

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  - c) 3
  - d) 4
  - e) 5
Jimmy

- 15 year old, quadriparetic non-spastic cerebral palsy
- S/P posterior spinal fusion
- Otherwise healthy
- What is his risk score?
  a) 1
  b) 2
  c) 3
  d) 4
  e) 5
Jimmy

- 15 year old, quadriparetic non-spastic cerebral palsy
- S/P posterior spinal fusion
- Otherwise healthy
- What is his risk score?
  a) 1
  b) 2
  c) 3
  d) 4
  e) 5
Charlotte

• 15 y/o morbid obese (BMI 42) with OSA (uses CPAP), PCOS on aldosterone and combined oral contraceptive tablets, DM2 on metformin. Not sexually active. Smoker.

• Admitted for gastric sleeve. Came out of OR with right internal jugular central triple-lumen catheter.

• She has severe SCFE s/p B/L recent hip pinning. Despite encouragement, her mobility is very limited.

• What is her risk score?
  
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  b) 2
  c) 3
  d) 4
  e) 5
Charlotte

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  a) 1
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  c) 3
  d) 4
  e) 5
Take home points

- VTE is a current risk factor for medical complications in children
  - Education is required for all stakeholders at multiple levels – trainees, nursing, staff, etc.

- There are multiple algorithms for VTE risk stratification and prophylaxis
  - Participation at OCHSPS provides with resources for QI bundle implementation

- Local institutional VTE risk stratification and prophylaxis tools can be built
  - Leveraging available published resources
  - Engagement of multidisciplinary team of stakeholders (pediatrics, surgery, hematology, orthopedics, infectious diseases, neurosurgery, pharmacy, etc.)
  - Its validation occurs by utilizing the tool.
References


THANK YOU!

auronm@ccf.org
Cleveland Clinic

Every life deserves world class care.