Prophylaxis Against Venous Thromboembolism (VTE) in Pediatric Trauma

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Disclosure Statement

• I disclose no conflict of interest relative to this educational activity.
Successful Completion

• To successfully complete this course, participants must attend the entire event and complete/submit the evaluation at the end of the session.

• Society of Trauma Nurses is accredited as a provider of continuing nursing education by the American Nurses Credentialing Center's Commission on Accreditation.
Objectives

• 1. Briefly review epidemiology of VTE in pediatric trauma
• 2. Identify sub-populations at high risk for VTE
• 3. Discuss prophylaxis strategies
• 4. Highlight challenges with initiating prophylaxis
Pediatric VTE Epidemiology

• Incidence of pediatric VTE is rising in hospitalized children [1]
  • 70% increase over a 7 year period

• The Solutions for Patient Safety (SPS) initiative found:
  • VTE accounts for 16% of all serious safety events in hospitalized children [2]
    • 2nd largest contributor to harm (CLABSI is 1st)

VTE Epidemiology in Pediatric Trauma

- In trauma specifically, 0.3-0.8% of hospitalized children per year will develop VTE [3,4]
  - ~ 750-2000 children per year

Why is this important?

- Morbidity and Mortality
- Cost
  - Pediatric patients with VTE have [5]:
    - Longer length of stay by median of 8.1 days (95% CI: 3.9-12.3)
    - Excess average cost of $27,686 (95% CI: $11,137 - $44,235) while hospitalized
      - Compared to hospitalized patients with similar age and condition(s)

Developing the PMG

• Convened team with representatives from:
  • Critical care
  • Hematology
  • Surgery
• Formulated our PICO questions
• Literature search
  • 14 articles met inclusion/exclusion criteria
PICO 1

• In children hospitalized after trauma (P), should pharmacologic VTE prophylaxis be utilized (I), compared to no pharmacologic prophylaxis (C), to reduce the incidence of VTE (O)?

• Pharmacologic prophylaxis = enoxaparin at 0.5 mg/kg/dose subcutaneous every 12 hours
PICO 1 - Evidence

• Children at high risk for VTE [6]
  • Age
  • Central venous catheters
  • ISS > 9
    • Highest risk cohorts: > 25
  • Other: intubation/mechanical ventilation, ICU admission

• Support for pharmacologic prophylaxis
  • Adults [7,8]
    • Two separate meta-analyses of adult patients showed decreased risk of VTE by 48% (particularly when given within 72 hours of surgery or trauma) and did not increase risk of bleeding
  • Pediatrics [9]
    • Non-significant reduction in symptomatic VTE

• Risk of bleeding? Limited to no data
  • In uncontrolled observational studies, the risk of bleeding in surgical adolescents receiving pharmacologic prophylaxis (4%) was similar to adults (2-3%) [10]

PICO 1 - Recommendation

• Conditional recommendation **for** pharmacologic prophylaxis if “at low risk for bleeding”:
  • > 15 years of age
  • Post-pubertal but < 15 years of age with ISS > 25

• Recommend **against** pharmacologic prophylaxis:
  • Pre-pubertal children
PICO 1 – Key Challenge

• What if the patient is bleeding?
• How do we “grade” levels of bleeding?
  • The International Society of Thrombosis and Haemostasis published a position statement [11] to define:
    • “Major”
      • Fatal bleeding, and/or
      • Symptomatic bleeding in a critical area or organ, e.g. intracranial, intraspinal, intraocular, retroperitoneal, intra-articular or pericardial, or intramuscular with compartment syndrome, and/or
      • Bleeding causing a fall in hemoglobin of 2 g/dL or more OR leading to transfusion of two or more “Units” of whole blood or red cells
    • “Minor”
      • Any bleeding that is non-major but requires the attention of a care-giver, provider, intervention, and/or pharmacologic agent

PICO 1 – Key Challenge

• Pharmacologic prophylaxis is most effective when initiated within 72 hours of hospital arrival [12,13]

• When to initiate pharmacologic prophylaxis if major bleeding is present?
  • Once bleeding is “controlled”
    • Stabilization of hemoglobin, and/or
    • Stabilization of bleed on imaging
  • Will have significant variance in clinical practice until further addressed through research
  • No clear answer but there are ongoing studies evaluating this

PICO 2

• In children hospitalized after trauma (P), should mechanical VTE prophylaxis be utilized (I), compared to no prophylaxis or in addition to pharmacologic prophylaxis (C), to reduce the incidence of VTE (O)?

• Mechanical VTE prophylaxis:
  • Sequential compression devices (preferred) [14]
  • Graduated compression stockings (not preferred) [15]

PICO 2 - Evidence

• Only two studies have indirectly evaluated efficacy of mechanical prophylaxis
  • One reported use at discretion of treating team [16]
    • Either medical or surgical – both with high acceptance rates for use
  • One study reported use as part of institutional guidelines [17]
  • Both studies reported a small reduction in VTE but did NOT separate mechanical alone from mechanical + pharmacologic
    • Although the number of patients receiving pharmacologic prophylaxis was quite low

• Both studies suffer from one key flaw: no documentation of actual use

• Neither study reported adverse events.
  • High level of safety from adult data [12]
  • High level of agreement to utilize from pediatric providers [18]

PICO 2 - Recommendation

• Conditional recommendation for mechanical prophylaxis alone or in combination for previously identified high risk groups:
  • > 15 years of age
  • Post-pubertal but < 15 years of age with ISS > 25

• Important to have appropriately-sized sleeve

• Key challenge is that use will often be excluded due to location of injury (e.g. lower extremities)
**PICO 3**

- In children hospitalized after trauma (P), should active surveillance for VTE with ultrasound be performed (I), compared to daily physical examination alone (C), to detect VTE earlier (O)?
PICO 3 - Evidence

• Only one study evaluated active surveillance with ultrasound [14]
• Objective was to identify VTE in patients contraindicated to receive prophylaxis by institutional guidelines
  • Compared to unselected historical controls, the group found that asymptomatic VTE could be detected 3 days earlier

• Challenges:
  • Timing, frequency, and extent of ultrasounds - ?
  • The natural hx of asymptomatic VTE is not defined
    • How many will resolve on their own? How many occur that we don’t know about?
  • Adult data has shown screening ultrasounds are not efficacious in reducing VTE [17]
  • Cost-benefit considerations

PICO 3 - Recommendation

• Conditional recommendation against active surveillance for VTE with ultrasound (compared to daily physical examination)
Summary

• VTE in pediatrics is increasing

• High risk features include:
  • Age ≥ 15
  • Post-puberty
  • Higher ISS, particularly ≥ 25

• Consider both pharmacologic and mechanical prophylaxis in the high risk groups
  • If pharmacologic prophylaxis used, monitor Hb and any focal area of bleeding
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