Should we screen children for coagulopathies prior to surgery?

*yes/ most of the time*

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Pre-surgical screening

• Screening for coagulopathies may include some or all of the following
  – medical history
  – personal bleeding history
  – familial bleeding history
  – routine laboratory testing (CBC, PT/aPTT)
  – specific blood coagulation testing
  – point of care (POC) testing
Medical history

• Demographic- age, ethnicity, etc.
• Nutrition status
• Underlying disease
  – Uremia, malignancy, metabolic disorder, etc.
• Medications
• Prior surgeries
• Type of planned surgery
Bleeding history

- Personal and family
- Open questions
- Structured questionnaire
Topic of discussion

Whether the medical, bleeding and familial bleeding history are sufficient for predicting bleeding risk prior to surgery in children

or whether additional routine laboratory tests are necessary?
Utility of bleeding history for predicting bleeding

- Preoperative bleeding questionnaire tested in 7730 children prior to tonsillectomy or adenotonsillectomy
- Administered by a pediatric ENT nurse at least 2 weeks prior to surgery

APPENDIX

Presurgical Bleeding History Questionnaire and Lab Requisition

A. PERSONAL HISTORY
1. Has your child ever had surgery, stitches for trauma, or a broken bone? Y N
   If YES, did your child experience bleeding during or after the procedure? Y N
   What was the procedure? ____________
   If a boy, did your child bleed after circumcision? Y N
   Did he/she bleed after the umbilical cord came off? Y N
2. Does your child bruise easily compared to normal? Y N
3. Do the bruises usually occur on more than one part of the body? Y N
4. Are the bruises ever the size of the base of a drinking glass (2 in) or larger? Y N
5. Does the patient ever get a large black and blue lump under his/her bruise? Y N
6. Has your child had frequent nosebleeds? Y N How often? ____________
7. Does it take more than 10 minutes for the nosebleed to stop? Y N
8. Is your child taking any of the following?
   a. Aspirin _________________
   b. Ibuprofen products _________________

B. FAMILY HISTORY
1. Has anyone in your family required a blood transfusion? Y N

C. MEDICATIONS
1. Is your child taking:
   a. Valproic acid? Y N
   b. Any other medication? Name ____________
      For how long ____________

TESTS TO BE ORDERED

For all patients Order CBC
YES to two or more questions 1 to 7 in section A: Order “COAG PREOP”
YES to question 4 or 5, section B or 1a section C: Order “COAG PREOP”
YES to questions 1, 2, or 3 in section B: physician’s discretion
YES to question 8 in section A: schedule surgery 2 weeks after drug discontinuation

COAG PREOP panel: CBC, PT/PTT, and a tube on hold (for VWF and other work-ups if history or PT/PTT abnormal)
46 patients were prepared with DDAVP and/or Amicar.
Utility of bleeding history for predicting bleeding

- Bleeding in those with positive bleeding history
  - $48/1948$ 2.5% (95% CI 1.8%-3.2%)
- Bleeding in those without bleeding history
  - $184/5782$ 3.2% (95% CI 2.7%-3.7%)

$p = 0.7$
Utility of bleeding history for predicating bleeding

• **Conclusion:** using structured bleeding questionnaire could not differentiate between bleeders and non-bleeders

• **Conclusion 2:** study design could not assess the utility of bleeding history in predicating bleeding disorder

Utility of bleeding history for diagnosis of bleeding disorder

• Retrospective study, Hematology/Oncology service
• 792 children referred prior to tonsillectomy and adenoidectomy for abnormal PT and/or PTT, and/or positive family history of bleeding.
• Bleeding history- no structured questionnaire
• Abnormal PT/aPTT were repeated. If remained abnormal, further testing

Utility of bleeding history for diagnosis of bleeding disorder

- 32 children (4%) were diagnosed with a bleeding disorders – mild to moderate VWD (n=21), low factor VII (n=5), hemophilia A (n=3), hemophilia B (n=1), dysfibrinoginemia (n=1), liver disease (n=1)

Utility of bleeding history for diagnosis of bleeding disorder

- 268 (34%) positive personal or family bleeding history; 17 (6.3%) diagnosed with bleeding disorder
- 524 (66%) no bleeding history; 15 (2.8%) diagnosed with bleeding disorder

$p=0.022$

Utility of bleeding history for diagnosis of bleeding disorder

• **Conclusion 1:** testing all patients with positive bleeding history will still result in >90% unnecessary testing

• **Conclusion 2:** testing only patients with positive bleeding history will result in missing almost 50% of patients with bleeding disorder

Utility of bleeding history for diagnosis of bleeding disorder

• **Conclusion 3:** If bleeding history is significant and CBC/PT/aPTT is normal, testing for VWD could increase the utility of the testing.

Decision analysis model

Decision analysis model

- no preoperative coagulation testing prior to T&A in children is the most cost effective, even when compared to selective testing of those with a pertinent history

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Cost</th>
<th>Utility (QALYs)</th>
<th>Incremental cost per QALY gained</th>
<th>Effectiveness (bleeds)</th>
<th>Incremental cost per bleed prevented</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test no one</td>
<td>$3,076.80</td>
<td>0.02659</td>
<td>—</td>
<td>0.06051</td>
<td>—</td>
</tr>
<tr>
<td>Test those with history</td>
<td>$3,083</td>
<td>0.02654</td>
<td>(Dominated)</td>
<td>0.06045</td>
<td>$104,024</td>
</tr>
<tr>
<td>Test all</td>
<td>$3,199.80</td>
<td>0.02579</td>
<td>(Dominated)</td>
<td>0.05874</td>
<td>$68,297</td>
</tr>
</tbody>
</table>

Why bleeding history is not predictive in children?

- Bleeding history in children may be misleading as challenges to the hemostatic system are often required to make a bleeding disorder clinically evident.
- Thus, a mild/moderate bleeding disorder may go undetected until events such as trauma, surgery, or menarche occur.
Utility of bleeding history for predicking bleeding - adults

- Prospective study
- 3041 tonsillectomies, > 15 years
- Bleeding history, not structured
- Laboratory test- PT, aPTT and if abnormal VWF, coagulation factors

Utility of bleeding history for predicating bleeding - adults

<table>
<thead>
<tr>
<th>History of coagulopathy</th>
<th>Total</th>
<th>No bleeding</th>
<th>Bleeding</th>
<th>( p ) value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>2,497</td>
<td>2,110 (84 %)</td>
<td>387 (16 %)</td>
<td>( { &lt;0.002 } )</td>
</tr>
<tr>
<td>Positive</td>
<td>55</td>
<td>38 (69 %)</td>
<td>17 (31 %)</td>
<td></td>
</tr>
<tr>
<td>Not evaluated</td>
<td>489</td>
<td>404 (81 %)</td>
<td>85 (17 %)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Laboratory screening for coagulopathy</th>
<th>Total</th>
<th>No bleeding</th>
<th>Bleeding</th>
<th>( p ) value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>2,249</td>
<td>2,101 (84 %)</td>
<td>390 (16 %)</td>
<td>( { &lt;0.235 } )</td>
</tr>
<tr>
<td>Positive</td>
<td>94</td>
<td>75 (80 %)</td>
<td>19 (20 %)</td>
<td></td>
</tr>
<tr>
<td>Not performed</td>
<td>456</td>
<td>376 (83 %)</td>
<td>80 (18 %)</td>
<td></td>
</tr>
</tbody>
</table>

*higher bleeding risk compared to children

Utility of bleeding history for predicating bleeding in children?
- No evidence

Utility of coagulation screening for predicting bleeding?
Utility of coagulation screening for predicting bleeding

• Utility of laboratory testing prior to surgery is likely related to-
  – the risk of bleeding in the surgery
  – to the size of the study (power)
Utility of coagulation screening for predicting bleeding

- Three studies in children prior to adenectomy, tonsillectomy
- The results of the coagulation screen did not predict bleeding
- Bleeding events-
  - 5/272  1.8% (95% CI 0.6%-4.2%)
  - 7/416  1.6% (95% CI 0.7%-3.4%)
  - 2/274  0.7% (95% CI 0.12%-2.3%)

Utility of coagulation screen for predicting bleeding

• Preoperative bleeding questionnaire tested in 7730 children prior to tonsillectomy or adenotonsillectomy

• Administered by a pediatric ENT nurse at least 2 weeks prior to surgery

Utility of coagulation screen for predicting bleeding

- Bleeding in children with abnormal coagulation
  - 9/141  6.4% (95% CI 2.3%-11.8%)
- Bleeding in children with normal coagulation
  - 39/1807  2.2% (95% CI 1.5%-2.9%)

p=0.002
Utility of coagulation screen for predicting bleeding

- 875 children prior to adenotonsillectomy
- All were screened for coagulopathies
- Post operative bleeding was associated with laboratory test results
  - 9/127 with abnormal lab
  - 22/748 with normal lab

$p=0.041$

Significance of bleeding

• No data in children

• In adults- post-surgical bleeding was the most common and most expensive complication after tonsillectomy
Significance of bleeding

Significance of bleeding

• Post-surgical bleeding may be a devastating event for the child and the family and may be associated with significant morbidity, health care utilization, and expenditures
Summary

• The utility of coagulation laboratory screening in children prior to surgery needs to be further studied, especially in procedures with a high risk of bleeding
Summary

• Future studies should be prospective with large sample size, using a standardized pediatric bleeding questionnaire, laboratory coagulation screening and bleeding outcome assessment
### Bleeding History

**Pediatric Bleeding Questionnaire**

A score \( \geq 2 \) was associated with bleeding disorders.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epistaxis</td>
<td>-</td>
<td>no or trivial (≤5)</td>
<td>&gt;5 or more than 10 min</td>
<td>consultation only</td>
<td>packing, cauterization or antifibrinolytics</td>
<td>blood transfusion, replacement therapy or desmopressin</td>
</tr>
<tr>
<td>Cutaneous</td>
<td>-</td>
<td>no or trivial (≤1 cm)</td>
<td>&gt;1 cm and no trauma</td>
<td>consultation only</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Minor wounds</td>
<td>-</td>
<td>no or trivial (≤5)</td>
<td>&gt;5 or more than 5-min duration</td>
<td>consultation only or steri-strips</td>
<td>surgical hemostasis or antifibrinolytics</td>
<td>blood transfusion, replacement therapy or desmopressin</td>
</tr>
<tr>
<td>Oral cavity</td>
<td>-</td>
<td>no</td>
<td>reported at least one</td>
<td>consultation only</td>
<td>surgical hemostasis or antifibrinolytics</td>
<td>blood transfusion, replacement therapy or desmopressin</td>
</tr>
<tr>
<td>Gastrointestinal tract</td>
<td>-</td>
<td>no</td>
<td>identified cause</td>
<td>consultation or spontaneous</td>
<td>surgical hemostasis, antifibrinolytics, blood transfusion, replacement therapy or desmopressin</td>
<td>-</td>
</tr>
<tr>
<td>Tooth extraction</td>
<td>no bleeding in at least 2 extractions</td>
<td>none done or no bleeding in 1</td>
<td>reported, no consultation</td>
<td>consultation only</td>
<td>resutting, repacking or antifibrinolytics</td>
<td>blood transfusion, replacement therapy or desmopressin</td>
</tr>
<tr>
<td>Surgery</td>
<td>no bleeding in at least 2 surgeries</td>
<td>none done or no bleeding in 1</td>
<td>reported, no consultation</td>
<td>consultation only</td>
<td>surgical hemostasis or antifibrinolytics</td>
<td>blood transfusion, replacement therapy or desmopressin</td>
</tr>
<tr>
<td>Menorrhagia</td>
<td>-</td>
<td>no</td>
<td>reported or consultation only</td>
<td>antifibrinolytics or contraceptive pill use</td>
<td>D&amp;C or iron therapy</td>
<td>blood transfusion, replacement therapy or desmopressin</td>
</tr>
<tr>
<td>Postpartum</td>
<td>no bleeding in at least 2 deliveries</td>
<td>no deliveries or no bleeding in 1 delivery</td>
<td>reported or consultation only</td>
<td>D&amp;C, iron therapy, antifibrinolytics</td>
<td>blood transfusion, replacement therapy or desmopressin</td>
<td>-</td>
</tr>
<tr>
<td>Muscle hematoma</td>
<td>never</td>
<td>post-trauma, no therapy</td>
<td>spontaneous, no therapy</td>
<td>spontaneous or traumatic, requiring desmopressin or replacement therapy</td>
<td>spontaneous or traumatic, requiring surgical intervention or blood transfusion</td>
<td>-</td>
</tr>
<tr>
<td>Hemarthrosis</td>
<td>never</td>
<td>post-trauma, no therapy</td>
<td>spontaneous, no therapy</td>
<td>spontaneous or traumatic, requiring desmopressin or replacement therapy</td>
<td>spontaneous or traumatic, requiring surgical intervention or blood transfusion</td>
<td>-</td>
</tr>
<tr>
<td>Central nervous system</td>
<td>never</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>subdural, any intervention</td>
<td>intracerebral, any intervention</td>
</tr>
<tr>
<td>Other:</td>
<td>-</td>
<td>no</td>
<td>reported</td>
<td>consultation only</td>
<td>surgical hemostasis, antifibrinolytics or iron therapy</td>
<td>blood transfusion, replacement therapy or desmopressin</td>
</tr>
</tbody>
</table>

- postcircumcision
- umbilical stump
- cephalohematoma
- macroscopic hematuria
- postvenepuncture
- conjunctival hemorrhage
Summary

• Until those studies are available most physicians will elect to perform CBC and coagulation laboratory tests in children with high risk for bleeding and/or prior to surgical procedures involved with high risk of bleeding.
Thank you