Paediatric Trauma

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Disclosures

• Nil real ones

• I am NOT a paediatrician
Trauma in Children

• Significance

• Trends

• Evolution in practice
In Australia 1-14yo

4829.0.55.001 - Health of Children in Australia:
Gender

Rate per 100,000 AIHW

Darker lines=boys
A few other features

- Rural/regional risk
- Indigenous risk
- Injury distribution
Specific topics - where are we at?

- Tranexamic acid in paediatric trauma
- Massive transfusion in kids
TXA- Current guidelines

Evidence Statement
Major trauma and the use of tranexamic acid in children
November 2012

Key points

- Tranexamic acid reduces mortality in adult trauma
- Early administration is vital for efficacy
- Due to the lack of published data on the use of tranexamic acid in paediatric patients who have undergone major trauma there is no evidence for a specific dose in this situation
- The RCPCH and NPPG Medicines Committee recommend a pragmatic dosage schedule - 15mg/kg tranexamic acid loading dose (max 1g) over 10 minutes followed by 2mg/kg per hour
HSC Criteria for the use of tranexamic acid in paediatric trauma

- Immediate need for transfusion, with any one of the following indicating severe shock
- Systolic blood pressure low (<80 mmHg <5 years and <90 mmHg ≥5 years)
- Poor blood pressure response to crystalloid 20–40 ml/kg
- Obvious significant bleeding

- The Hospital for Sick Children Massive Hemorrhage Protocol for the use of tranexamic acid in pediatric trauma. April 2014.
High quality direct data on TXA in kids.....
So what rationale?

- Grown ups – CRASH 2

- Surgery...

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**REVIEW ARTICLE**

**The Efficacy of Antifibrinolytic Drugs in Children Undergoing Noncardiac Surgery: A Systematic Review of the Literature**

David Faraoni, MD, FCCP* and Susan M. Goobie, MD, FRCPC†

Children undergoing major surgery are frequently exposed to a high risk of blood loss often requiring transfusion. Although the risks associated with blood product transfusion have considerably decreased over the last decade, transfusion is still associated with significant morbidity and mortality. Thus, rigorous efforts should be made to decrease surgical bleeding and the need for blood product transfusion. Antifibrinolytic drugs have been shown to be effective when used in both adult and pediatric surgical patients. While there are data in adults to support safety, data remain limited for pediatric patients. Since the restriction of aprotinin use in 2008, the most commonly used antifibrinolytic drugs have been the lysine analogs, tranexamic acid (TXA), and e-aminoacapric acid, which inhibit the conversion of plasminogen to plasmin and decrease the degree of fibrinolysis. We performed a systematic review of the literature pertaining to the efficacy of antifibrinolytic drugs in children undergoing noncardiac surgery. During spine surgery, both TXA and e-aminoacapric acid decrease blood loss and transfusion requirements; however, this information comes from small, mainly retrospective trials. Two prospective, randomized, controlled trials have tested the efficacy of TXA in children undergoing craniofacial surgery and have reported that TXA decreases transfusion requirements. Two pharmacokinetic trials were also recently published and are summarized in this review. No data have been published regarding the efficacy of TXA administration in the pediatric trauma population. Further data are still needed in this field of study, and we discuss some perspectives for future research. (Anesth Analg 2014;118:828–36)

Children undergoing major surgery are frequently exposed to a high risk of perioperative bleeding with concomitant requirement of blood product transfusion. This increases the risk of postoperative adverse outcomes, resulting in longer length of hospital stay and increased morbidity and mortality. The underlying mechanisms that increase the bleeding risk differ depending on the type of surgery performed. For example, our main experience comes from children undergoing cardiac surgery with Activation of the fibrinolytic system, leading to conversion of the inactive substrate plasminogen to plasmin, is a major component of the vascular hemostatic mechanisms to maintain vascular patency. Multiple pathways can activate plasmin generation, including endothelial activation, contact activation, and kallikrein-mediated plasmin activation. These physiologic mechanisms help maintain equilibrium between clot formation and clot lysis, resulting in thrombosis remote from sites of injury. In cases of trauma or major sur-

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**THE CHANGING FACE OF ANAESTHESIA AND PAIN MEDICINE**
Questions

• Are kids really the same here?
  – Differences in thrombosis patterns
  – Seizures

• Kinetics- limited data
  – Do we have dosing right?
Upshot....

• Still many questions

• Reasonable rationale to use in manner analogous to adults

• More robust data needed
Massive transfusion in kids
The impact of blood product ratios in massively transfused pediatric trauma patients.


A pediatric massive transfusion protocol

Sara J. Chidester, Nick Williams, Wei Wang, and Jonathan I. Groner. J Trauma Acute Care Surg. 2012 November; 73(5)

Implementation of a pediatric trauma massive transfusion protocol.


• Significant issues with existing data....
Rationale and Pragmatism vs Evidence
Massive Transfusion Pack

Immediate Dispatch

The following "pack" will be despatched immediately upon activation of the MTP³ according to patient weight:

<table>
<thead>
<tr>
<th>Weight of Child</th>
<th>&lt; 15kg</th>
<th>15 – 30kg</th>
<th>30 – 50kg</th>
<th>&gt; 50kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 unit PRBC³</td>
<td>2 unit PRBC</td>
<td>3 unit PRBC</td>
<td>4 unit PRBC</td>
<td></td>
</tr>
<tr>
<td>1 unit FFP³</td>
<td>2 unit FFP</td>
<td>3 unit FFP</td>
<td>4 unit FFP</td>
<td></td>
</tr>
<tr>
<td>1 unit pooled platelets</td>
<td>1 unit pooled platelets</td>
<td>1 unit pooled platelets</td>
<td>1 unit pooled platelets</td>
<td></td>
</tr>
</tbody>
</table>

Specimen tubes for sample collection from patient after administration of products will be sent with each pack. Pathology form (tests pre-printed) included.

² PRBC = Packed Red Blood Cells
³ FFP = Fresh Frozen Plasma

Second Dispatch

Upon request for a second lot of blood products, the following will be issued according to weight:

<table>
<thead>
<tr>
<th>Weight of Child</th>
<th>&lt; 15kg</th>
<th>15 – 30kg</th>
<th>30 – 50kg</th>
<th>&gt; 50kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 unit PRBC</td>
<td>2 unit PRBC</td>
<td>3 unit PRBC</td>
<td>4 unit PRBC</td>
<td></td>
</tr>
<tr>
<td>1 unit FFP</td>
<td>2 unit FFP</td>
<td>3 unit FFP</td>
<td>4 unit FFP</td>
<td></td>
</tr>
<tr>
<td>2 units cryoprecipitate</td>
<td>3 units cryoprecipitate</td>
<td>5 units cryoprecipitate</td>
<td>8 units cryoprecipitate</td>
<td></td>
</tr>
</tbody>
</table>

Specimen tubes for sample collection from patient after administration of products will be sent with each pack. Pathology form (tests pre-printed) included.

By this stage, the on-call Haematologist will be involved, and will direct further products in consultation with the clinical team. The principles of further replacement will be:

- 1:1 ratio of PRBC to FFP³,⁴,⁵
- Alternating platelets and cryoprecipitate, but adjusted according to laboratory results⁶.
- Factor concentrates such as activated factor VII ("Novoseven") or prothrombin complex concentrates ("Prothrombinex") may be indicated, and this will be the decision of the on-call Haematologist in consultation with the clinical team⁶,¹¹,¹².
Summary

• Trauma is a key issue in paediatrics and is singularly germane to the prehospital and retrieval world

• Advances in adult circulatory management appear to be appropriate to translate to children

• In this matter they can be treated as ....”little adults”??!!