Tranexamic Acid in Total Hip and Knee Arthroplasty

The Problem
At BIDMC, 20% of patients undergoing elective total hip or total knee arthroplasty (THA and TKA) receive an allogeneic blood transfusion during their hospitalization, predisposing them to transfusion risks (i.e. hemolysis, transfusion-related lung injury, anaphylaxis, infection) while utilizing a very limited resource. Tranexamic acid (TXA) is an anti-fibrinolytic medication used in surgeries to limit blood loss. Its benefits in orthopedic surgeries have been established, but its applicability to our patient population has not been examined and a clear protocol for its use is not established at our institution. We compared the blood transfusion rates and drops in post-operative hematocrit levels in patients undergoing THA or TKA with and without the use of TXA to elucidate how it can be used to enhance patient safety.

Aim/Goal
Our goal is two-fold:
1) Determine how effectively TXA reduces blood transfusions in TKA and TKR.
2) Implement a protocol for its use for anesthesiology staff.

The Team
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The Interventions
- We administered 1g of TXA (or 10mg/kg) to all patients having primary total hip or knee arthroplasty prior to incision. Patients were included in this treatment if they did not have the following contraindications:
  - History of deep vein thrombosis or pulmonary embolus
  - Preoperative coagulation abnormalities (i.e. unusual factor deficiencies)
  - Preoperative anticoagulation
  - Significant concern for coronary or intracerebral thrombosis
  - Color blindness
- We collected data about pre- and post-operative hemoglobin levels, blood transfusions, and thromboembolic events.
- With the positive results obtained, we then educated anesthesiology staff on indications for TXA in orthopedic populations and protocolized its administration.

The Results/Progress to Date

<table>
<thead>
<tr>
<th>Surgical Type</th>
<th># Cases</th>
<th>Preop Hb</th>
<th>POD1 Hb</th>
<th># Allogeneic Transfusions</th>
<th># Autologous</th>
<th>Lowest Hb</th>
</tr>
</thead>
<tbody>
<tr>
<td>TKA control</td>
<td>24</td>
<td>13.1 +/- 1.3</td>
<td>9.9 +/- 1.1</td>
<td>8 U in 5 pts</td>
<td>0</td>
<td>6.4 POD2</td>
</tr>
<tr>
<td>TKA w/ TXA</td>
<td>17</td>
<td>13.7 +/- 1.6</td>
<td>10.7 +/- 1.3</td>
<td>3 U in 2 pts</td>
<td>0</td>
<td>6.9 on POD5</td>
</tr>
<tr>
<td>THA control</td>
<td>20</td>
<td>13.6 +/- 2.0</td>
<td>10.2 +/- 1.7</td>
<td>6 U in 4 pts</td>
<td>4 U in 4 pts</td>
<td>5.5 POD1</td>
</tr>
<tr>
<td>THA w/ TXA</td>
<td>19</td>
<td>13.7 +/- 1.3</td>
<td>11.0 +/- 1.4</td>
<td>3 U in 2 pts</td>
<td>4 U in 4 pts</td>
<td>6.7 on POD3</td>
</tr>
</tbody>
</table>

Transfusion rates for allogeneic blood in total knee arthroplasties:
- TKA: 8 Units in 5 patients = 1.6 U/patient transfused.
- 8 Units/24 patients = 33% transfusion rate.
- 5 patients transfused per 24 patients total = 21% of patients transfused.
- TKA w/ TXA: 3 U in 2 patients = 1.5 U/patient transfused.
- 3 U/17 patients = 17.6% transfusion rate.
- 2 patients per 17 total transfused = 11.8% of patients transfused.

Transfusion rates for allogeneic blood in total hip arthroplasties:
- THA: 6 U in 4 patients = 1.5 U/patient transfused.
- 6 U/20 pts = 30% transfusion rate.
- 4 patients transfused per 20 total patients = 20% of patients transfused.
- THA w/ TXA: 3 U in 2 patients = 1.5 U/patient transfused.
- 3 U/19 patients = 15.8% transfusion rate.
- 2 patients transfused per 19 total = 10.5% of patients transfused.

Lessons Learned
- Despite the shown benefits of TXA, there were challenges in education of anesthesiologists about its use in these settings. These were overcome by providing educational materials, individual consultations, and signage in the orthopedic operating rooms.
- The hemoglobin concentration continued to decrease over post-op days 2 and 3, and transfusion was occasionally required after post-op day 1.
- Patients with preoperative anemia (Hg < 12) were more likely to require transfusion.

Next Steps/What Should Happen Next
- Continue to educate anesthesiology staff about the indications and benefits of TXA in primary total hip and knee arthroplasties.
- Determine if a second dose of TXA on post-op day 0 or post-op day 1 would be helpful in decreasing anemia and transfusion.
- Detect strategies to detect and reduce the incidence of preoperative anemia.

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