Pre-op haemoglobin optimisation algorithm and its effects on transfusion rates in elective orthopaedic surgical patients

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Aim:
To improve the care and reduce the rate of transfusion of elective orthopaedic patients by reducing the risk of attending for surgery with pre-existing anaemia.

Method:
- In 2012 an algorithm was developed for patients attending pre-admission clinic for major elective orthopaedic surgery
- The algorithm guided the investigation and management of haemoglobin and ferritin levels. Ferritin was added if the patient was anaemic, however this changed in 2015 to routine testing. Current algorithm shown (Figure 1).
- Haematology, anaesthetics and gastroenterology were involved in the development of the algorithm to ensure appropriate follow up and testing of patients. Regular meeting of the group to assess the impact of the strategies occurred. Problems identified could then be addressed and improvements made.
- Introduction of an anaesthetic pathway for orthopaedics in 2015 incorporated suggestions regarding tranexamic acid use and indication for red cell transfusion (Figure 2).
- Data was collected to assess the use and effectiveness of the algorithm and compared with historical data. The results were assessed by the group and fed back to the orthopaedic unit regularly.

Results:

Table 1: Demographics

<table>
<thead>
<tr>
<th>Year</th>
<th>Male: Female ratio</th>
<th>Age range (median)</th>
<th>Blood replacements</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>76:155</td>
<td>20-69 (65)</td>
<td>104</td>
</tr>
<tr>
<td>2015</td>
<td>82:102</td>
<td>20-69 (65)</td>
<td>105</td>
</tr>
<tr>
<td>2016</td>
<td>94:111</td>
<td>20-69 (65)</td>
<td>123</td>
</tr>
<tr>
<td>2017</td>
<td>103:49</td>
<td>20-69 (65)</td>
<td>35</td>
</tr>
</tbody>
</table>

- Each year more women than men attend for surgery
- The median age has remained constant
- There are similar numbers of hip and knee replacement surgeries

Table 2: Comparison of data for years, since implementation of the algorithm

<table>
<thead>
<tr>
<th>Year</th>
<th>No. patients anaemic</th>
<th>No. patients treated with low ferritin</th>
<th>No. patients treated anaemic and low ferritin</th>
<th>Ferritin &lt;10 µg/L</th>
<th>Ferritin 10-20 µg/L</th>
<th>Ferritin 20-30 µg/L</th>
<th>Ferritin &gt;30 µg/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>21 (9)</td>
<td>6295 (21)</td>
<td>69 (21)</td>
<td>10 (5)</td>
<td>5 (3)</td>
<td>22 (9)</td>
<td>9 (4)</td>
</tr>
<tr>
<td>2015</td>
<td>26 (14)</td>
<td>27194 (14)</td>
<td>271 (14)</td>
<td>1777 (22)</td>
<td>5 (2)</td>
<td>1117 (22)</td>
<td>5 (4)</td>
</tr>
<tr>
<td>2016</td>
<td>16 (8)</td>
<td>89 (3)</td>
<td>22 (9)</td>
<td>22 (11)</td>
<td>5 (2)</td>
<td>77 (9)</td>
<td>7 (4)</td>
</tr>
<tr>
<td>2017</td>
<td>18 (9)</td>
<td>59 (3)</td>
<td>13 (3)</td>
<td>57 (11)</td>
<td>37 (9)</td>
<td>37 (11)</td>
<td>37 (11)</td>
</tr>
</tbody>
</table>

- The median age has remained constant
- There are similar numbers of hip and knee replacement surgeries

The data is for all elective hip and knee replacements.

In 2015, we were one of 12 health services to become part of the National Patient Blood Management Collaborative, at this time we commenced ongoing auditing.

- The number of patients determined anaemic by our algorithm is small, approximately 10% over the 5 years
- Routine testing of ferritin has demonstrated a greater percentage of patients with low ferritin, indicating iron deficiency, approximately 17% overall
- Of those with a decreased ferritin only a small percentage (<5%) are anaemic
- Of those with anaemia or iron deficiency the majority receive treatment in the form of IV iron
- Where there is anaemia without iron deficiency, the anaemia is often long standing and the patient is receiving treatment e.g. EPO in chronic renal disease, treatment for myelodysplasia

Follow up post treatment requires further attention.

We have also implemented this algorithm in elective abdominal surgery and aim to introduce this to other surgical groups.

Conclusion:
The use of a preoperative algorithm for anaemia assessment and optimisation works as an important part of good patient practice.

Many practices have changed over the past 5 years and thus we are unable to attribute the reduction in transfusion rates to any single factor. However increased awareness of staff of the risks of transfusion, optimisation of haemoglobin preoperatively, the use of single unit transfusion, the increased use of tranexamic acid and the increased focus on patient blood management guidelines have all helped to improve patient care.

Whilst we have had success in implementing the management of pre-operative anaemia for those with iron deficiency as a cause, other causes of anaemia are more difficult to correct, particularly long standing causes of anaemia.