Quality improvement in elective joint replacement surgery

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• Letterkenny General Hospital (LGH) is an acute general and maternity Hospital
• Serves 147,000 inhabitants of County Donegal
• 320 beds
• Saolta group
Letterkenny General Hospital
• Redesigning Peri-operative Care for Patients Undergoing Joint Replacement Surgery
  – Dr Paul O’Connor

• Reducing Peri-Operative Blood Transfusions In Patients Undergoing Elective Hip And Knee Arthroplasty
  – Dr Louise Moran, Mr Sean Murphy, Dr Anne Flood
Prospective randomised controlled trial
Blood Transfusions

• 10-90% of Total hip replacements
• 0-39% of Total Knee replacements
• 10% of all blood transfusion in the UK are used for these two procedures

Blood transfusions can be bad...

- Preoperative anaemia / Autologous Blood Transfusions (ABT)
- Increased risk of peri-operative adverse outcomes
- Increased post-operative infections
- Increased hospital length of stay (LOS)
- Increased mortality.

Blood management programmes are good...

How good was Letterkenny?

- Elective hip or knee replacement at Letterkenny General Hospital between 2010 and 2012 were assessed retrospectively
- age and sex of the patients
- pre-operative haemoglobin (Hb)
- transfusion trigger Hb / reason for transfusion
- number of units transfused
2010-2012

- 636 patients
- 2010  18%
- 2011  19%
- 2012  12%
To reduce the number of patients receiving post-operative blood transfusions in patients undergoing elective knee and hip arthroplasty from 12% to 6% by September 2013 in Letterkenny General Hospital.

**Driver Diagram**

- Decrease the % of patients presenting to surgery with anaemia
  - Identify anaemia in pre-operative patients (WHO guidelines)
  - Treat anaemic patients to reduce pre-operative anaemia
  - Design a treatment protocol for treating anaemia within a limited time frame

- Decrease intra-operative blood loss
  - Implement protocol for administration of tranexamic acid to pharmacologically reduce blood loss

- Decrease inappropriate post-operative blood transfusion
  - Agree transfusion triggers with a multidisciplinary team approach
  - Implement regulation of blood products by laboratory staff
Pre-surgery anaemic status of units received

- Anaemic pre-surgery: 130 units, 59%
- Non-anaemic pre-surgery: 90 units, 41%

Legend:
- Blue: Number of Units received
- Red: Percentage of units received
Is the patient anaemic?
Hb <130 g/L (male) or
Hb <120 g/L (female)

Preoperative tests
• Full blood count
• Iron studies\(^2\) including ferritin
• CRP and renal function

No anaemia: ferritin <100 mcg/L
• Consider iron therapy\(^4\) if anticipated postoperative Hb decrease is ≥30 g/L
• Determine cause and need for GI investigations if ferritin is suggestive of iron deficiency <30 mcg/L\(^2,3\)

Iron deficiency anaemia
• Evaluate possible causes based on clinical findings
• Discuss with gastroenterologist regarding GI investigations and their timing in relation to surgery\(^4\)
• Commence iron therapy\(^4\)

Possible iron deficiency
• Consider clinical context
• Consider haematology advice or, in the presence of chronic kidney disease, renal advice
• Discuss with gastroenterologist regarding GI investigations and their timing in relation to surgery\(^4\)
• Commence iron therapy\(^4\)

Possible anaemia of chronic disease or inflammation, or other cause\(^5\)
• Consider clinical context
• Review renal function, MCV/MCH and blood film
• Check B12/folate levels and reticulocyte count
• Check liver and thyroid function
• Seek haematology advice or, in the presence of chronic kidney disease, renal advice

No

YES

Ferritin <20 mcg/L\(^2,3\)

CRP\(^4\)
• Raised
• Normal

Ferritin 20–100 mcg/L\(^2,3\)

Ferritin >100 mcg/L

NO

This protocol is for patients undergoing major orthopaedic surgery in Letterkenny General Hospital. This work is based on/includes The National Blood Authority’s Patient Blood Management Guideline: Module 2 – Perioperative which is licensed under the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 Australia licence.
To reduce the number of patients receiving post-operative blood transfusions in patients undergoing elective knee and hip arthroplasty from 12% to 6% by September 2013 in Letterkenny General Hospital.

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Tranexamic Acid

• 2013 data
• 204 patients out of 231 received tranexamic acid
• Hb drop decreased from 2.88g/dL to 2.24g/dL
• Transfusion rate
  – 2.4% in tranexamic acid group
  – 11.1% in non recipients of tranexamic acid
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Decrease the % of patients presenting to surgery with anaemia

Decrease intra-operative blood loss

Decrease inappropriate post-operative blood transfusion

Identify anaemia in pre-operative patients (WHO guidelines)
Treat anaemic patients to reduce pre-operative anaemia
Design a treatment protocol for treating anaemia within a limited time frame

Implement protocol for administration of tranexamic acid to pharmacologically reduce blood loss

Agree transfusion triggers with a multidisciplinary team approach
Implement regulation of blood products by laboratory staff
Inappropriate blood transfusions

• 48% of blood transfusions from 2010-2012 were potentially inappropriate
• Of those who required transfusion, 65% were over transfused
• Introduction of governance of hospital blood transfusion
How did we do?
Percentage of elective hip and knee replacements requiring perioperative blood transfusion

% transfused

% transfused nationally UK 2011

Project aim for % transfused
How did we do?

• 2010     18%
• 2011     19%
• 2012     12%
• 2013     3.5%
Potential health benefits

• Blood is an immunosuppressant
• Reduction in infections
  – Pneumonia 2.6% vs 5%
  – Periprosthetic joint infections 2% vs 4.3%
  – Sepsis 6% vs 12%
  – wound infections 4% vs 9%
Potential health benefits

• Length of stay (LOS)
  – BMP reduced LOS from 6 to 5 days for THR
  – BMP reduced LOS from 6 to 4 days for TKR
  – In Letterkenny we reduced LOS from 8.8 days to 5.1
Potential health benefits

- **Mortality**
  - 4.26% vs 6.44% all non cardiac surgery
  - 2.43x mortality rate if have pre-operative anaemia

- **Transfusion related immune modulation**
  - Association between ABT and cancer recurrence

- **Incompatability / infection / coagulopathy**

Cost savings

- Unit of blood €250-€570

<table>
<thead>
<tr>
<th>Year</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
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<tbody>
<tr>
<td>No. of units transfused</td>
<td>80</td>
<td>76</td>
<td>64</td>
<td>8</td>
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<tr>
<td>Total cost</td>
<td>€20,000-€45,600</td>
<td>€19,000-€43,320</td>
<td>€16,000-€36,000</td>
<td>€2000-€4560</td>
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</tbody>
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- Total saving €18,000 - €41,040
Potential national savings

• HSE in 2010 performed 4678 elective hip and knee arthroplasties
• National average transfusion rate = 25%  
  – €700,000
• Cost with a transfusion rate of 3.5%  
  – €100,000
• Potential savings of €600,000
• 1005 patients nationally could have avoided ABT
Challenges

• Retrospective data collection
  – Poor documentation
  – Difficulty retrieving notes

• Pre-operative anaemia optimisation protocol
  – Haematologist approval
  – Pre-operative assessment nurse agreement

• Blood product regulation
  – Blood bank regulation of transfusion triggers
  – Single unit transfusion policy

• Maintenance of quality improvement project
Conclusion

• Small incremental changes are easier to make than large ones
• Early stakeholder involvement and agreement is necessary to evoke change
• We reduced blood transfusion in a specific surgical population from 19% to 3.5%
• Reduction in morbidity and mortality
• Nationally 1005 patients could have avoided transfusion
Conclusion

• Cost savings locally €41,040
• Potential cost saving nationally €600,000
• LOS reduction of 1-2 days per patient
• Expansion of the blood management programme could be expanded across hospital specialties
• Opportunity to develop a National Blood Management Programme