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

	2012	2015	2016	2017 (5 months data only)
Male: Female ratio	76:155	82:102	94:111	31:49
Age range (median)	21-91 (69)	37-91 (69)	25-90 (69)	27-87 (68)
Knee replacements	127	81	82	45
Hip replacements	104	103	123	35

- 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

Orthopaedics	2012 N=231 (%)	2015 N=184 (%)	2016 N=205 (%)	2017 N=80 (%) – to end of May
No. patients anaemic	21 (9)	26 (14)	16 (8)	7 (9)
No. patients tested with low ferritin	NA	6/29 (21)	27/194 (14)	17/77 (22)
No. patients both anaemic and low ferritin	NA	5 (3)	5 (2)	3 (4)
No. patients who received treatment for anaemia or low ferritin	NA	9 -8 received Fe infusion	22 -19 received Fe infusion	11 -11 received Fe infusion
Use of tranexamic acid	NA	78 (43)	131 (64)	57 (71)
Transfusion rate	80 (35)	32 (17)	24 (12)	7 (9)
Anaemic pre-op & transfused post-op	15/21 (71)	13/26 (50)	7/16 (44)	3/7 (43)
Single unit transfusions	12/80 (15)	7/32 (22)	8/24 (33)	3/7 (43)

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
- Since the introduction of this algorithm the intra-operative use of tranexamic acid for orthopaedic patients has become common practice
- The transfusion rate in this group of patients has steadily reduced over the 5 year period, with a corresponding increase in the number of single unit transfusions
- Although the algorithm suggests the re-testing of Hb and ferritin 4 weeks after treatment or on the day of surgery if less than 4 weeks, it is very rare that this is occurring

Results:

Figure 1. Preoperative Haemoglobin Optimisation Algortihm

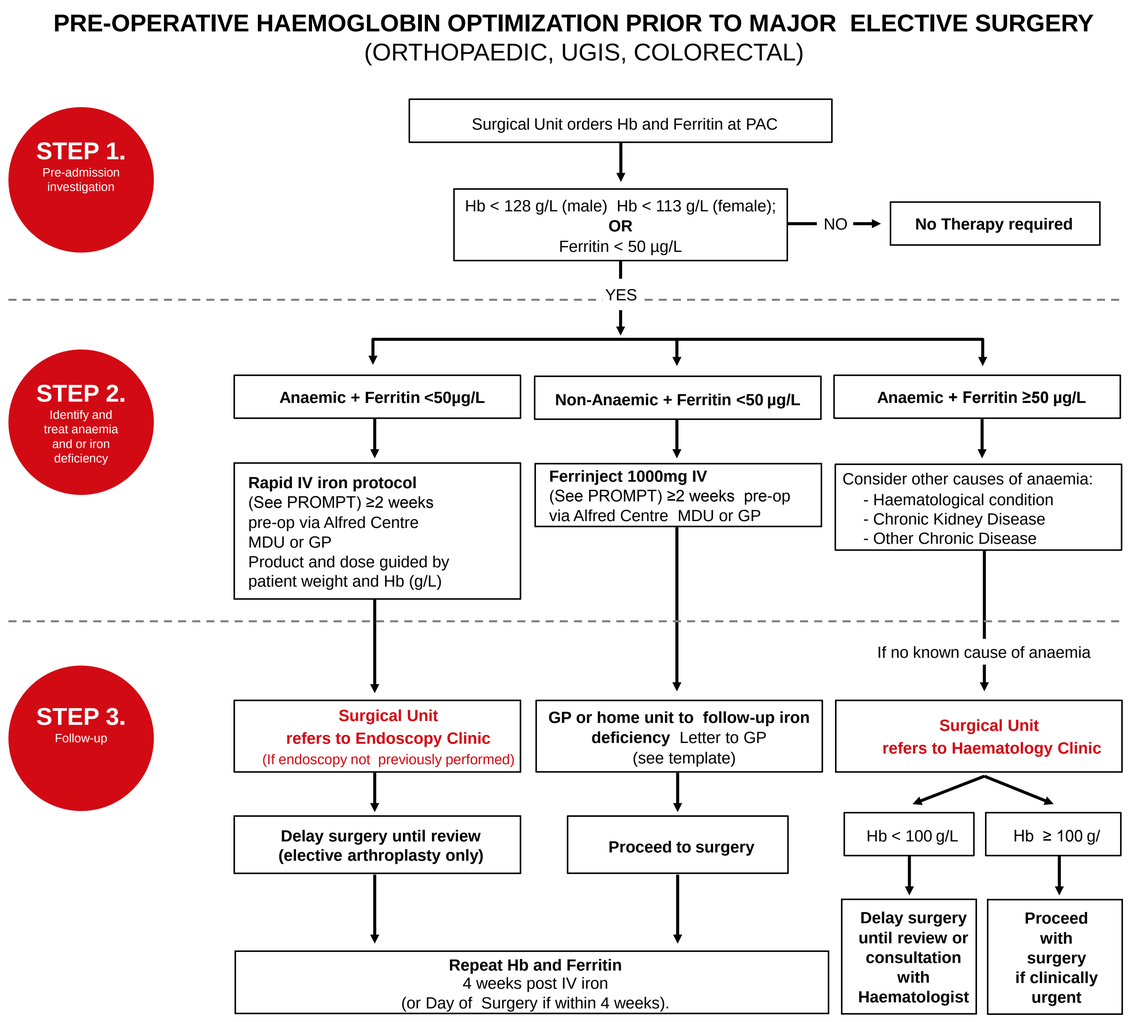

Figure 2: Enhanced Recovery after Surgery pathway

Anaesthetic Pathway for ERAS Orthopaedics

Pre-operative: Paracetamol 1g PO + Pregabalin 150mg PO (75mg if frail) [holding bay]
Pre-operative haemoglobin optimisation protocol for patients with anaemia

Intra-operative:

Technique of Choice: Spinal anaesthetic with sedation *and* LIA done by surgeons*
2-3.5mL of 0.5% bupivacaine (heavy) – no intrathecal opiate, with propofol sedation

2nd preference: GA *and* LIA +/- wound catheter.

3rd preference: GA *and* femoral nerve block
– Use *low concentration block i.e.* 20-40ml of 0.25% bupivacaine or 0.375% ropivacaine.
Use this technique if the surgeon does not do a LIA & document why LIA not used

Antibiotics: Single dose antibiotic prophylaxis as per guideline

Analgesia: Parecoxib 40mg IV (LIA no longer contains NSAID)

Antiemetics: All patients must receive prophylactic combination antiemetics (dexamethasone and ondansetron)

Antifibrinolytics: Consider Tranexamic acid 1g IV over 15 min if high risk of bleeding, revision surgery or pre-operative anaemia. Do not give if high thrombosis risk.

Fluids and temperature control

Avoid excessive intravenous fluids e.g. restrict to <4mls/kg/hr.
Upper body forced air heating cover and fluid warmer

Register all patients on the APS list

***LIA = 0.2% Ropivacaine (up to 4mg/kg) with 5mcg/ml adrenaline eg.**

<50kg = 100mL of 0.2% Naropin® Polybag®
50-75kg = 125mL
75-100kg = 150mL
>100kg = 200mL

Postoperative

Analgesia

- **Paracetamol** 1g QID
- **Celecoxib** 200mg BD
  (If already taking NSAID/coxib, continue with normal medication. If NSAIDs contraindicated then avoid and add in tramadol. Start celebrex on day 1.)
- **Pregabalin** 75mg BD
- **Oxycontin 20mg** BD for knee arthroplasty
  or **10mg** BD for hip arthroplasty
- **Endone** 5-10mg PRN 2hrly

Adjuncts

- **Omeprazole** 20mg OD, or other PPI, if prescribed NSAIDs
- **Ondansetron** 4mg BD

DVT Prophylaxis

- **Clexane 40mg daily**
  – 6 hours post operation

Antibiotics:

- 2 further postoperative doses

Transfusion of red cells:

- Stable patient + Hb <70g/L
- Post-op with AMI or cerebral ischaemia - Hb <90g/L

Single unit followed by reassessment

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 pre-operatively, 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.

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.