

**A patient blood management (PBM) service at
Royal Cornwall Hospitals Trust (RCHT)
reduces transfusion rates for combined
revision total hip replacement (rTHR) surgery.**

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Introduction

- **58-72% transfusion rates for rTHR surgery¹⁻²**
- 66,000 hip operations in England and Wales in 2013
- Decreasing transfusion rates;
 - Avoidance of serious pathological consequences of allogeneic transfusion
 - Transfusion errors
 - Cost saving and rationing

1. Walsh TS *et al.* Multicentre cohort study of red blood cell use for revision hip arthroplasty and factors associated with greater risk of allogenic blood transfusion. *BJA* 2012;108(1):63-71
2. Verlicchi F, Desalvo F, Zanotti G, Morotti L, Tomasini I. Red cell transfusion in orthopaedic surgery: a benchmark study performed combining data from different data sources *Blood transfusion* 20011;9:383-7

The importance of PBM in hip surgery

- Allogeneic blood transfusion (ABT) increases risk of post-operative wound infection (4.2% compared to 1% with autologous transfusion)³
- ABT increases length of post-operative stay (LOS)⁴⁻⁵
- Pre-operative anaemia independently increases risk of transfusion and post-operative length of stay, morbidity and mortality⁶

3. Rosencher N *et al.* Orthopedic Surgery Transfusion Hemoglobin European Overview (OSTHEO) study: blood management in elective knee and hip arthroplasty in Europe. *Transfusion* 2003;43(4):459-69.

4. Mahadevan D, Challand C, Keenan J. Revision total hip replacements :predictors of blood loss, transfusion requirements, and length of hospitalization. *J Orthopaed Traumatol* 2010;11;159-65

5. E Nworah, CJ Ralph, L Jakt. Using PCS for revision hip surgery reduces risk of allogeneic blood transfusion. *Transfusion Medicine* 2012;22(1) PO31

6. Spahn DR. Anaemia and patient blood management in hip and knee surgery; a systematic review of the literature *Anaesthesiology* 2010;113:482-95

Blood conservation strategies for hip surgery include;

- Correction of pre-operative anaemia
- Reduction of intra-operative blood loss (anti-fibrinolytics, anaesthetic and surgical techniques)
- Perioperative cell salvage (PCS)
- Post-operative restrictive transfusion triggers

PCS for reducing transfusion

- Has been shown to reduce transfusion rates following hip surgery⁷⁻⁹
- Good safety record, 12 cases included, no deaths or major morbidity in the 2013 SHOT report
- Salvaged blood has preserved levels of 2,3-DPG, and has a higher pH than stored blood. There is reduced need for replacement of clotting factors.
- Risks/concerns of PCS include bone/fat/cement/bacterial contaminants, sickle cell, thalassemia

7. Bridgens JP, Evans CR, Dobson PM, Hamer AJ. Intraoperative red blood-cell salvage in revision hip surgery: a case-matched study. *J Bone Joint Surg Am* 2007;89(2):270-5

8 . Herd JM. Intraoperative cell salvage in revision hip surgery *Annals of Medicine and Surgery* 2014;3:8-12

9. Carless PA *et al.* Cell salvage for minimising perioperative allogeneic blood transfusion. *Cochrane Database Systematic Review* 2006;18(4):CD001888

Patient blood management at RCHT

- At RCHT we aim to use PCS routinely for all surgery with blood loss, and reserve a PCS machine for every rTHR case
- Referral system to PBM team for pre-operative optimisation of anaemia
- We aim to achieve normal pre-operative Hb (>120g/L) for all patients
 - Intravenous iron; Ferinject (ferric carboxymaltose) or Venofer (iron sucrose)
 - Erythropoietin (Aranesp 300mcg s/c)

Iron deficient, with or without anaemia, as defined by: Ferritin <30 CRP < 20

OR

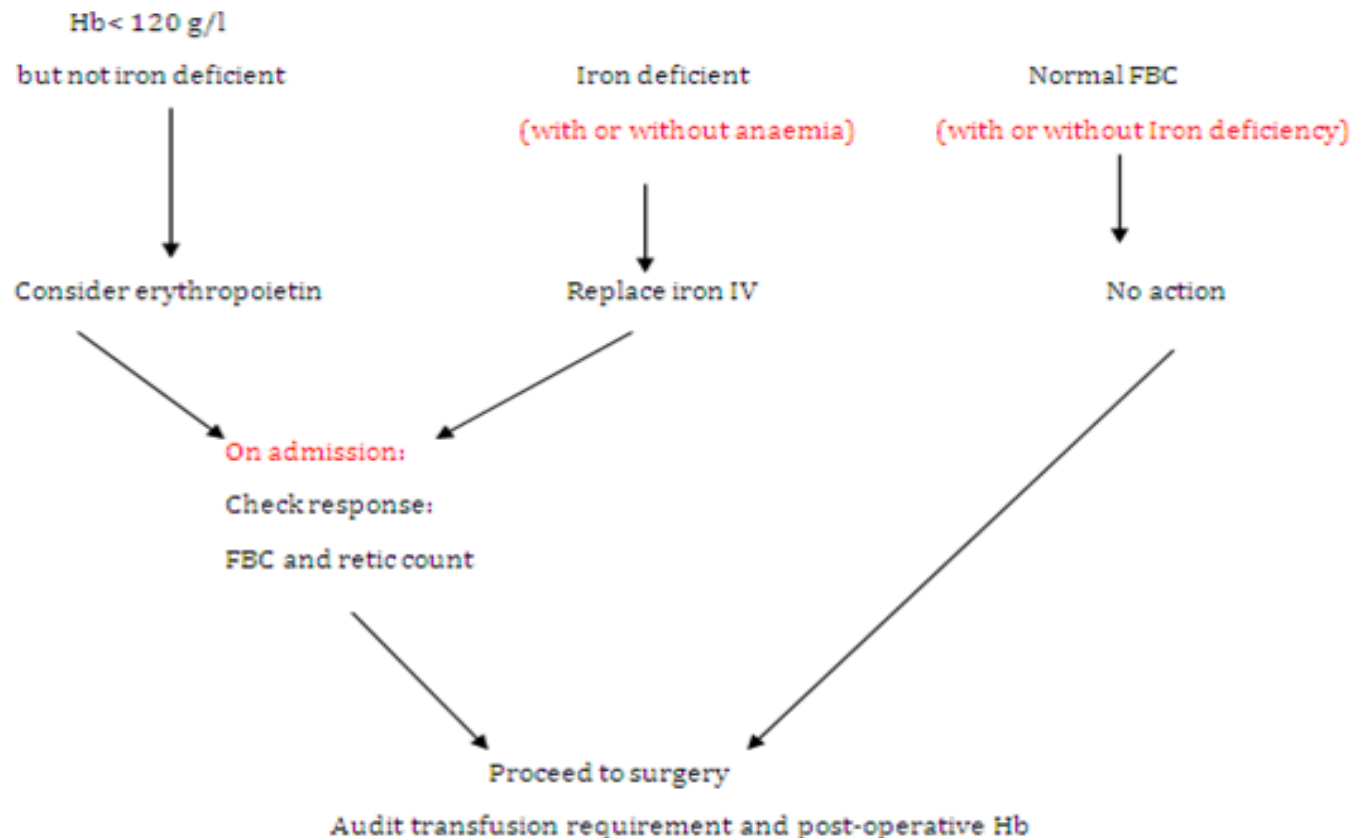
Ferritin < 70 CRP > 20

OR

anaemia with hypochromia or microcytosis.

Or anaemic with or without Iron deficiency Hb <120 g/l

Pre-Admission Clinic 3-4 weeks before surgery- check FBC, reticulocyte count and iron status



Aims of this project

Primary aim;

- To identify our local rate of transfusion for combined rTHR surgery

Secondary aims;

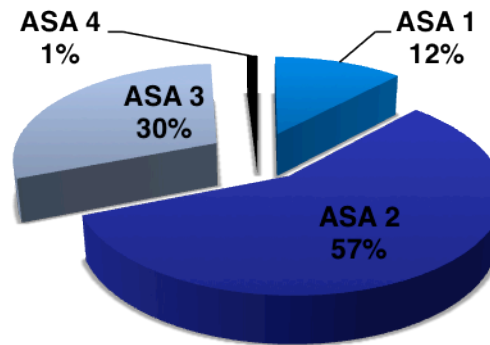
- Pre-operative optimisation
- Perioperative techniques
- Use of the PCS machines, and volume of blood re-infused
- Length of stay
- Estimate costs/savings

Method

- Retrospective audit of all patients undergoing combined rTHR surgery between April 2013 and April 2014
- From real time database and review of casenotes

Demographics

- 84 patients were included for analysis
- Age [mean(range)]
66y (29-89)
- ASA
 - 12% ASA 1
 - 57% ASA2
 - 30% ASA 3
 - 1% ASA 4
- Operating time [mean(range)]
170min (71-357)
- Estimated blood loss [mean(95%CI)]
650ml (538-794)



Pre-optimisation

- 88% went into surgery with a pre-operative Hb of more than 120g/L
 - Average pre-op Hb 136g/L
- 8 patients (10%) received pre-operative Hb optimisation
 - 4 received intravenous iron only
 - 4 received intravenous iron and erythropoietin
 - Mean Hb gain was 22g/L
 - One of these patients went on to receive post-operative transfusion
- 7 patients received post-operative intravenous iron infusion (of these 2 patients also received blood transfusion)

Use of PCS

- PCS was used in 95% cases
 - Electa/cell saver 5 (61 cases)
 - Orthopat (18 cases)
- Of these >46% received re-infusion of autologous blood
 - EBL mean 840ml (range 210ml-2000ml)
- Average volume re-infused was 264ml (range 50-976)
- Of all patients mean next-day Hb 107g/L (range 66-138)
 - 94% patients >80g/L

Allogeneic blood transfusion (ABT)

- 7 patients **8%** received ABT, total 11 units (mean 1.6 units per patient)
- 1 patient was transfused in the perioperative period, the remaining were transfused post-operatively according to restrictive transfusion guidelines
- Their mean pre-operative Hb was lower (114g/L), and mean length of operating time was higher (225min)
- They tended to be older, have more co-morbidities and higher mean ASA.
- The average length of post-operative stay was longer
- 1/7 returned to theatre for wound washout due to infection

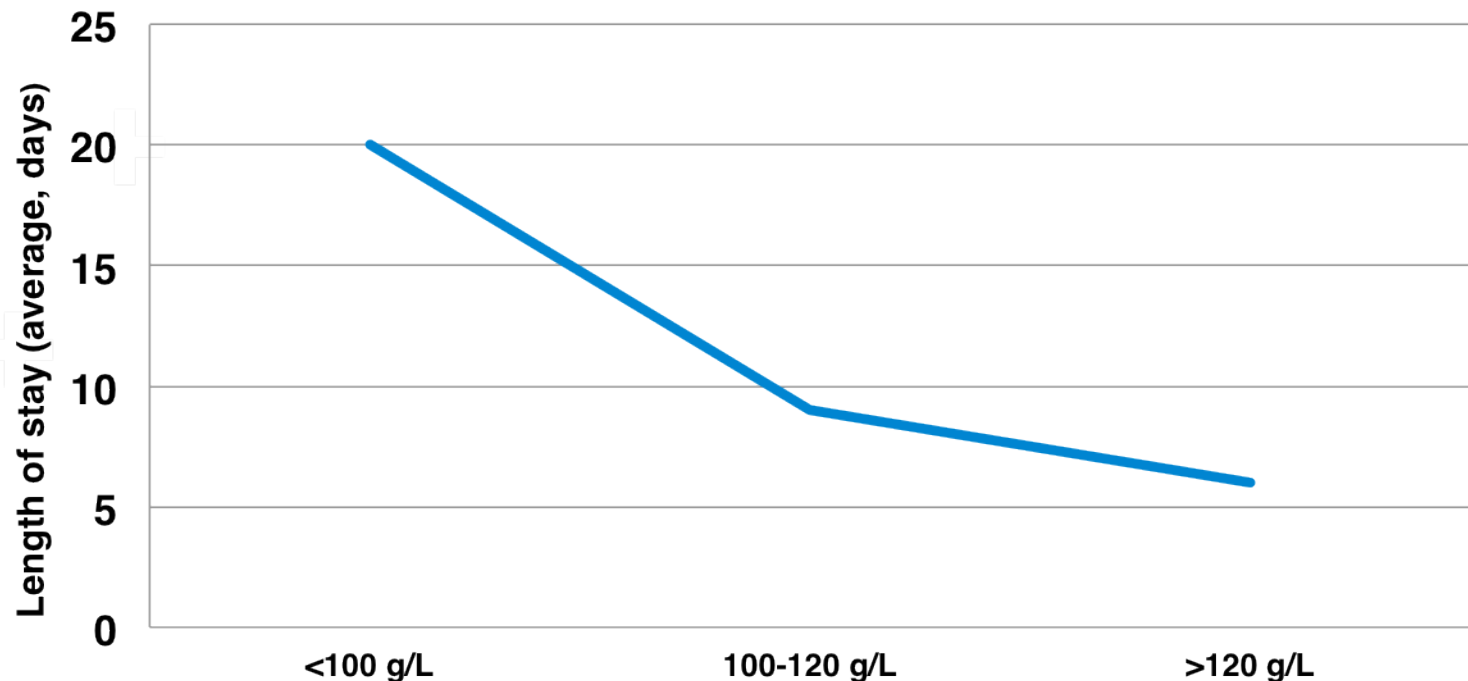
	Transfused (n=7)	Not transfused (n=77)
Age (mean)	79 y	65 y
ASA (mean)	2.6	2.17
Pre-operative Hb (mean)	114 g/L	138 g/L
Pre-optimised (number)	1 (2/7 post-op IV iron)	7
Use of PCS [number(%)]	5 (70%)	75 (97%)
Length of operation (mean)	225 min	165 min
Length of stay (mean)	14 d	6 d

Reduction in intra-operative blood loss

- Anaesthetic technique;
 - majority of patients received GA plus neuroaxial technique
 - We did not see any pattern in volume of blood loss between the different techniques
- 60% received intra-operative IV tranexamic acid

Relationship between pre-operative Hb and length of postoperative hospital stay

Average length of stay and pre-operative Hb



We can see an association between pre-operative anaemia and increased length of stay

Length of stay is increased in those that received blood transfusion

There is an association between receiving transfusion and having LOS > 6days

	Los= or <6 days	Los >6 days	total
Transfused	2 (4.42) [1.32]	5 (2.58) [2.26]	7
Not transfused	51 (48.58) [0.12]	26 (28.42) [0.21]	77
Total	53	31	84

The Chi-square statistic is 3.90

The P value is 0.048

This result is significant at $p < 0.05$

Cost Analysis

Savings	Costs
<p>reducing cost of blood = £9587 pa</p> <ul style="list-style-type: none"> •58% transfusion rate of 1.8 units¹ = £10,962 vs £1,375 <p>Cost of one excess bed day= approximately £264-£282* per day</p> <p>Reduction in cost of treating complications, readmissions, failure to achieve targets and cancellation of elective lists for bed shortages</p> <p>*DoH reference costs 2011-2012</p>	<p>Minimal training costs; OPD take on the operation of PCS machine in theatre</p> <p>Cost of consumables-approximately £7330 pa</p>

Conclusions

- **8% transfusion rate** following rTHR surgery
- Those patients that received pre-operative optimisation had a good outcome
 - 88% of all patients had Hb >120g/L
- PCS used in 95% cases, >46% received re-infusion of blood of just over 1 unit equivalent
 - No report of harm
- We see a trend towards increased LOS (14 vs 6 days) in those receiving transfusion and those with pre-operative anaemia
- Favourable cost savings; reduced LOS and cost of blood

Discussion and future work

- These results support our continued routine use of PCS for all combined revision hip replacement surgery
- Correction of pre-operative anaemia contributes greatly to blood conservation, we should aim to achieve closer to 100% of patients with Hb >120g/L on the day of surgery
 - refining the referral process and encouraging early referrals
- We would recommend this approach to other centres

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Royal Cornwall Hospitals

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Comments and Questions?

Thank you for listening