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Transfusion Threshold in Orthopaedic Surgery

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The rationale behind allogeneic blood transfusion

- is to **restore oxygen delivery** and **provide a reserve** should further bleeding occur
- thus **alleviating tissue hypoxia** and **improving outcome**
- **indicators for blood transfusion** (level of **oxygen carriers** and evidence of the **oxygen tissue debt** of anaemic origin)
- Reliable indicators: **mixed venous blood saturation (SvO2)**, **partial tissue oxygen pressure** (usually unavailable)
- [3] Decisions are based on **Hb** and/or **symptoms**

Transfusion
the risk of complications still persists

- graft-versus-host disease
- metabolic disorders
- bacterial contamination
- transfusion-related acute lung injury (TRALI)
- transfusion-associated circulatory overload (TACO)
- transfusion-related immuno-modulation (TRIM)

Transfusion-related immuno-modulation (TRIM)

data from different observational studies > 20,000 orthopaedic surgical patients strongly suggest that allogeneic blood transfusion is associated with a **dose-dependent increase in the risk of post-operative infection and mortality**

Rosencher N et al (OSTHEO) study Transfusion 2003
Carson JL et al Transfusion 1999
Bierbaum BE et al J Bone Joint Surg Am. 1999
Llevelyn CA et al Transfusion 2004
Izuel Rami et al Med Clin (Barc) 2008

Large inter-centre variability in Ortho Transfusions

Austrian benchmark study, considerable variability

- blood transfusion rate (**16-85%** for primary THR, **12-87%** for primary TKR)
- blood loss volume (**25-60%** of total red blood cell mass for THR, **24-47%** for TKR)

Orthopaedic Surgery Transfusion Haemoglobin European Overview (OSTHEO) study

Italian benchmark study

Gombotz et al. Transfusion 2007
Muñoz et al. Blood Transf. 2013

patients undergoing orthopaedic surgery

- a number of studies have demonstrated that the implementation of a restrictive transfusion trigger reduced transfusion rates and did not increase **morbidity** or **mortality** rates or the **length of hospital stay**

RCTs comparing restrictive versus liberal transfusion triggers in orthopaedic patients

Authors (year)	Transfusion trigger	Patients (N)	ABT rate N (%)	ABT volume (U/pte)	Cardiovascular morbidity N (%)	Infection N (%)	Length of stay (days)	30-day mortality N (%)
Carson *et al.* (1998)	L: Hb <10 g/dL	42	41 (98)	2.0 ± 0.9	ND	0 (0.0)	6.3 ± 3.4	1 (2.4)
	R: signs of acute anaemia or Hb <8g/dL	42	19 (45)	1.8 ± 1.1	ND	1 (2.4) Pneumonia	6.4 ± 3.4	1 (2.4)
Grover *et al.* (2006)	L: Hb <10 g/dL	109	46 (43)	0 (0–10)	2 (1.8)	5 (4.6)	7.5 (6–8)	1 (0.9)
	R: Hb <8 g/dL	109	37 (34)	0 (0–5)	5 (4.6)	4 (3.7)	7.3 (7–8)	0 (0.0)
Foss *et al.* (2009)	L: Hb <10 g/dL	60	44 (73)	2 (1–2)	1 (1.7)	11 (18.3)	18 ± 15	0 (0)
	R: Hb <8 g/dL	60	22 (37)	1 (1–2)	6 (10.0)	6 (10.0)	16 ± 12	5 (8)
Carson *et al.* (2011)	L: Hb <10 g/dL	1,007	970 (96)	1.9	114 (11.3)	83 (8.2)	USA	52 (5.2)
	R: signs of acute anaemia or Hb <8g/dL	1,009	415 (41)	1.6	135 (13.4)	59 (5.8)	3.7 ± 3.4	43 (4.3)
							4.0 ± 3.9	
							Canada	
							12.0 ± 9.3	
							12.7 ± 9.5	
So-Osman *et al.* (2013)	L: standard practice	304	119 (39.1)	1.0 ± 1.6	27 (8.9)	31 (10.2)	10.2 ± 7.4	3 (1.0)
	R: new risk-tailored uniform protocol**	299	79 (26.4)	0.6 ± 1.4	30 (10.0)	16 (5.4)	9.6 ± 5.1	0 (0)

Legend

ABT: allogeneic blood transfusion; Hb: Haemoglobin; L: liberal transfusion protocol; R: restrictive transfusion protocol.

Transfusion in euvolaemic, non-bleeding patients:

- the risk of anaemia and the risks and benefits of red cell transfusion should be carefully **balanced for each individual patient**

- **"liberal"** transfusion protocols (pre-transfusion haemoglobin concentration **>9-10 g/dL**) should be generally **avoided**

- should allogeneic blood transfusion deemed necessary, **single unit transfusions** are desirable;

- patients should be **reassessed between transfusions** to determine the remaining transfusion needs.

Cochrane Library
Cochrane Database of Systematic Reviews

Red blood cell transfusion for people undergoing hip fracture surgery (Review)

- six trials (2722 participants): all compared two thresholds: a **'liberal'** strategy 10 g/dL versus a more **'restrictive'** strategy based on symptoms of anaemia or a lower haemoglobin concentration, usually 8 g/dL.
- **no** evidence of a difference in **mortality**, at 30 or 60 days
- **no** evidence of a difference in **functional recovery** at 60 days
- **no** difference **VTE, stroke, wound infection, respiratory infection, congestive heart failure, myocardial infarction (low quality evidence)**
- currently available evidence **does not support the use of liberal red blood cell transfusion thresholds**

people who are symptomatic or haemodynamically unstable who were excluded

Exception from restrictive protocols

- there are **no trials**, the effects of restrictive transfusion triggers **in high-risk groups**

- Patients presenting with **acute myocardial infarction**
- **unstable angina**

- or other organ dysfunction (**heart failure**, **respiratory insufficiency**, **sepsis**, etc.)

- it seems sensible to adopt a less restrictive transfusion protocol aimed at maintaining haemoglobin levels between **9 g/dL and 10 g/dL**

Current Ortho Guidelines
Hb < 8 g/dL

- ***Clinical Practice Guidelines From the AABB:*** *Red Blood Cell Transfusion Thresholds and Storage, Jeffrey L. Carson et al,* ***JAMA. 2016****;316(19):2025-2035, October 12, 2016*

- ***Management of HIP fractures in the elderly*** *Evidence Based Clinical Practice Guideline: Adopted by the* ***American Academy of Orthopaedic Surgeons****, Board of Directors, September 5, 2014*

Our enhanced recovery protocols in THA, TKA

- Normal public or private hospital setting
- All patients
- MIS surgery, TXA 2 way, LIA, no IV opioids, NSAIDS
- No drains
- Multimodal analgesia
- Same day mobilization on crutches
- Threshold for transfusion HB: 7,5 – 8, individualized
- Transfusion HIPs: --%, Knees --%
- Next day exit to home: 90% hips
- 2 days knees: 90%

Conclusions

- Despite **recent progress** made on the basis of high-quality clinical trials, **many uncertainties remain** in the identification and implementation of best transfusion practices.

- The presumed benefits of blood transfusion are being challenged by the findings of recent trials, which show that **restrictive transfusion practices are equivalent or better** than liberal transfusion practices.

- **Additional data are needed** to establish the optimum use of red cell, platelet, and plasma transfusions in different clinical settings—eg, trauma.