# Периоперативна Анемија

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# Anemia



## Talking anemia is offensive??? Paradigm

- Started a study for Anemia and PBM issues
- In 80 primary care settings
- Not Published, GOING ON
- DEVESTATING



## Facts



- prevalence 5-75%( Shander et al.2004)
- 50% is iron deficiency anemia

- de Benoist B et al., eds. Worldwide prevalence of anaemia 1993-2005. WHO Global Database on Anaemia Geneva, World Health Organization, 2008
  - the global prevalence of anaemia in 2011 World Health ...

https://apps.who.int > iris > bitstream > handle > 9789241564960\_eng



Anaemia in the older surgical patient: a review of prevalence, causes, implications and management

International Surgery Journal
Sonwani B et al. Int Surg J. 2016 Feb;3(1):71-76
http://www.ijsurgery.com

pISSN 2349-3305 | eISSN 2349-2902

**Research Article** 

DOI: http://dx.doi.org/10.18203/2349-2902.isj20151535

Anaemia in surgical patients and its effect on recovery of patients

J R Soc Med 2013: 106: 269-277. DOI: 10.1177/0141076813479580

## Facts -surgery

- >30% have anemia on the day of surgery
- 48 % (>65y)have unexplained anemia
- cardiac surgery (40,4%), Emergency hip(>45%)
- Surgery, age, gender and status

Steinberg A et al. Anesth Intensivmed 2015;56:64-74

## Anemia is harmless- we have weapon for that?



• MOST CLINICANS THINK TRANSFUSION IS THE WEAPON

• ARE WE SURE?



## *Eur. J Anesthesiology 2017; 34: 332-395*

 Preoperative anemia in adults and children appears to be a strong predictor for perioperative blood transfusion across various types of conditions and surgeries and may be associated with adverse events. B

## Anemia as a risk

• Anemia is – RISK FACTOR – multi dimensional

- Fowler BJM 2015
- Mild anemia- (colorectal surgery >20 000) (AMI, stroke, death)
  - Leichete J. Am Coll Surg 2011
- Independent predictive risk mortality and death

Beatie et all, 2009;Spahn D, 2010;Musllam et al, 2011

- Preop anemia Co existing anemia increases health care costs
  - Dowling,2007;
  - Kaser et al 2019

Increases the adverse events

Fredericke C et al 2019

• Predictor for transfusion, and transfusion costs

- Munoz, BJA 2015
- Kaser et al 2019





>5 mil pts (24 mil of units blood) yearly

(ANNUAL SUMMARY OF THE REPORTING ADVERESE REACTIONS AND EVENTS 2015, EUROPIAN COMMISION.



- With such numbers, WE HAVE TO CHANGE OUR ATTITUDES
- AWERNESS YES, BUT ADRESSALBNES ALSO is a matter of thing
- DOING SMTH.
- Anemia has influence on every part of the perioperative part

	DETECTION AND MANEGMENT ANEMIA	MINIMISATION OF BLOOD LOOS AND BLEEDING	MANEGMENT ANEMIA AND IMPROVE TOLERANCE
PRE-OP	<ul> <li>Aim for assessment of anaemia 4–6 weeks before surgery</li> <li>Identify, evaluate and treat anaemia</li> <li>Treat absolute or functional iron deficiency with oral or i.v. iron</li> <li>Consider erythropoiesis stimulating agents if nutritional anaemia is ruled out/treated</li> <li>Refer for further</li> </ul>	<ul> <li>Identify and manage bleeding risk (past medical and family history)</li> <li>Review medications (antiplatelet, anticoagulation therapy)</li> <li>Minimize iatrogenic blood loss</li> <li>Procedure planning and rehearsal</li> </ul>	<ul> <li>Compare estimated blood loss with patient specific tolerable blood loss</li> <li>Assess and optimize patient's physiologic reserve e.g. pulmonary and cardiac function</li> <li>Formulate patient-specific management plan using appropriate blood conservation modalities</li> </ul>
INTRA-OP	<ul> <li>evaluation as necessary</li> <li>Schedule surgery         with optimization         of red cell mass</li> </ul>	<ul> <li>Meticulous haemostasis and surgical techniques</li> <li>Anaesthetic blood sparing techniques e.g. central neuraxial blockade</li> <li>Balanced physiology to aid optimal coagulation</li> <li>Patient positioning</li> <li>Goal directed management using point of care and VET</li> <li>Antifibrinolysis and cell salvage</li> </ul>	<ul> <li>Optimize cardiac output</li> <li>Optimize oxygenation and ventilation</li> <li>Evidence based transfusion thresholds</li> </ul>
POST-OP	<ul> <li>Stimulate erythropoiesis</li> <li>Manage nutrition and correctable anaemia (e.g. avoid folate deficiency, iron restricted erythropoiesis)</li> </ul>	<ul> <li>Antiformolysis and cell salvage</li> <li>Monitor and manage bleeding</li> <li>Avoid secondary haemorrhage</li> <li>Maintain normothermia (unless specifically indicated)</li> <li>Autologous blood salvage</li> <li>Minimize iatrogenic blood sampling loss</li> <li>Haemostasis/anticoagulation managemen</li> </ul>	<ul> <li>Maximize oxygen delivery</li> <li>Minimize oxygen consumption</li> <li>Avoid/treat infections promptly</li> <li>Evidence based transfusion thresholds</li> </ul>



The timely application of EBM concepts designed

to maintain HB concentrations, optimize hemostasis minimize blood loss in a effort to improve patient outcome

Interdisciplinary Managing **Blood Conservation** Anemia Modalities **IMPROVED** PATIENT OUTCOMES Optimizing Patient-Centered Coagulation Decision Making

WHO ASSEMBLY – PBM – PATIENT SAFTYY WHA 63.12 RESOLUTION WHO MEMENERS SHOUD IMPLEMENT PBM organization chart per the Society for the advanced Blood Management



META-ANALYSIS

OPEN

Multimodal Patient Blood Management Program Based on a Three-pillar Strategy

#### A Systematic Review and Meta-analysis

Friederike C. Althoff,\* Holger Neb, MD,\* Eva Herrmann, PhD,† Kevin M. Trentino,‡ Lee Vernich,§ Christoph Füllenbach, PhD,\* John Freedman, MD,¶ Jonathan H. Waters, MD, || Shannon Farmer, MD,\*\*†† Michael F. Leahy, MD,11 Kai Zacharowski, MD, PhD,\* Patrick Meybohm, MD,\* and Suma Choorapoikavil, PhD\*

Objectives: To determine whether a multidisciplinary, multimodal Patient Blood Management (PBM) program for patients undergoing surgery is effective in reducing perioperative complication rate, and thereby is effective in improving clinical outcome.

Background: PBM is a medical concept with the focus on a comprehensive anemia management, to minimize iatrogenic (unnecessary) blood loss, and to harness and optimize patient-specific physiological tolerance of anemia. Methods: A systematic review and meta-analysis was performed. Eligible studies had to address each of the 3 PBM pillars with at least 1 measure per pillar, for example, preoperative anemia management plus cell salvage plus

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rational transfusion strategy. The study protocol has been registered with PROSPERO (CRD42017079217).

Results: Seventeen studies comprising 235,779 surgical patients were included in this meta-analysis (100,886 pre-PBM group and 134,893 PBM group). Implementation of PBM significantly reduced transfusion rates by 39% [risk ratio (RR) 0.61, 95% confidence interval (CI) 0.55-0.68, P < 0.00001 ], 0.43 red blood cell units per patient (mean difference -0.43, 95% CI -0.54 to -0.31, P < 0.00001), hospital length of stay (mean difference -0.45, 95% CI -0.65 to -0.25, P < 0.00001), total number of complications (RR 0.80, 95% CI 0.74-0.88, P < 0.00001), and mortality rate (RR 0.89, 95% CI 0.80-0.98, P = 0.02).

Conclusions: Overall, a comprehensive PBM program addressing all 3 PBM pillars is associated with reduced transfusion need of red blood cell units, lower complication and mortality rate, and thereby improving clinical outcome. Thus, this first meta-analysis investigating a multimodal approach should motivate all executives and health care providers to support further PBM activities.

Keywords: blood transfusion, complication rate, effectiveness, mortality,

(Ann Surg 2019;269:794-804)

- 200 000 patients with or without PBM
- Different types of surgery
- Risk for transfusion
- Transfusion rates per patients
- LOHS
- Mortality rate

### No of patients exposed to allogenic RBC

			PBM	1	Control (pro	e-PBM)		Risk Rati	Risk Ratio
		Study or Subgroup	Events	Total	Events	Total	Weight M-	H, Random, 95% CI	M-H, Random, 95% CI
	- N	Orthonedic surge	ary.						
	- `	So-Osmann 2014	32	190	29	127	3.0%	0.74 [0.47 1.16]	+
orthoped	ic	Rineau 2016	5	183	24	184	1.1%	0.21 [0.08 0.54]	
orthoped	<u> </u>	Konanidis 2016	6	100	10	104	1.0%	0.60 [0.22, 1.50]	
	V	Lobus 2016	771	6503	1252	5007	1.0%	0.60 [0.23, 1.39]	
		Lottus 2016	//1	0232	1253	2331	5.8%	0.56 [0.52, 0.61]	•
		Holt 2016	14	1010	325	1814	2.5%	0.08 [0.05, 0.13]	
		Freedman 2008	200	1127	266	1089	5.3%	0.73 [0.62, 0.86]	-
		Ma 2014	3	33	12	37	0.8%	0.28 [0.09, 0.91]	
		Morais 2014	0	71	95	347	0.2%	0.03 [0.00, 0.40]	←
		Albinarrate 2015	81	357	111	271	4.7%	0.55 [0.44, 0.70]	-
		Frew 2016	9	406	107	717	1.8%	0.15 [0.08, 0.29]	
		Theusinger 2014	656	6721	431	2150	5 7%	0.49 [0.44, 0.54]	
		Mauhohm 2016	2050	16208	731	12622	5.770	0.03 [0.97, 0.06]	
		Meybonm 2016	2852	10238	2407	12033	5.9%	0.92 [0.87, 0.96]	
		Leahy 2014	63	2343	96	2669	4.0%	0.75 [0.55, 1.02]	
		Subtotal (95% CI)		35432		28135	41.7%	0.45 [0.35, 0.59]	
		Total events	4692		5166				
		Heterogeneity: Tau <sup>2</sup> =	0.16; Chi	<sup>2</sup> = 290.0	05, df = 12 (	P < 0.000	01); I <sup>2</sup> = 96%		
		Test for overall effect:	Z = 5.87	(P < 0.00)	001)				
	$\mathbf{i}$								
cardio	>	Cardiac surgery							
caraio		Ereedman 2008	110	275	165	274	5 39/	0.72 [0.61 0.85]	-
		Preedinal 2000	115	273	200	274	3.3/6	0.72 [0.01, 0.05]	_ '
•		Brevig 2009	80	479	229	530	4.9%	0.42 [0.34, 0.52]	+
		Leany 2014	34	266	81	295	3.6%	0.47 [0.32, 0.67]	
		Gross 2015	473	2275	152	387	5.4%	0.53 [0.46, 0.61]	-
		Moskowitz 2010	62	586	249	586	4.5%	0.25 [0.19, 0.32]	-
		Meybohm 2016	3837	7904	3378	5630	6.0%	0.81 [0.78, 0.83]	
		Subtotal (95% CI)		11785		7702	29.7%	0.50 [0.36, 0.70]	
		Total events	4611		4254				
		Heterogeneity: Tau <sup>2</sup> =	0.17-Chi	$^{2} = 156.2$	df = 5 (P)	< 0.0000	1): $I^2 = 97\%$		
		Test for overall effect:	7 - 4.00	(P < 0.00)	01)				
		rescion overall effect.	2 - 4.001	11 < 0.00	(01)				
	$\mathbf{i}$	Veccular							
vascular	>	vascular surgery							
Tastala		Freedman 2008	105	232	143	287	5.1%	0.91 [0.76, 1.09]	7
		Leahy 2014	17	406	20	471	2.0%	0.99 [0.52, 1.86]	
		Meybohm 2016	2119	5823	1731	4377	5.9%	0.92 [0.88, 0.97]	1
		Subtotal (95% CI)		6461		5135	13.1%	0.92 [0.88, 0.96]	•
		Total events	2241		1894				
		Heterogeneity: Tau <sup>2</sup> =	0.00: Chi	$^{2} = 0.06$ .	df = 2 (P =	$0.97$ : $I^2 =$	0%		
		Test for overall effect:	7 = 3.41	(P = 0.00)	06)				
	N	reschor overall effect.	2 - 3.11	(1 - 0.00	100)				
	しく	Companylana							
general		General surgery		1270	<b>C1</b>	1053	3.70/	1 22 /2 22 1 22	
general	_ /	Leany 2014	50	1276	61	1853	3.7%	1.33 [0.93, 1.90]	
		Meybohm 2016	2772	13694	2051	9164	5.9%	0.90 [0.86, 0.95]	1
	*	Subtotal (95% CI)		14970		11017	9.6%	1.05 [0.73, 1.53]	
		Total events	2828		2112				
		Heterogeneity: Tau <sup>2</sup> =	0.06; Chi	<sup>2</sup> = 4.49,	df = 1 (P =	0.03); I <sup>2</sup> =	78%		
		Test for overall effect:	Z = 0.27	(P = 0.78)	0				
	- \								
other		Other field							
	¬ /	Meybohm 2016	6259	49856	4818	36513	6.0%	0.95 [0.92, 0.99]	
	V	Subtotal (95% CI)	0233	49856	4010	36513	6.0%	0.95 [0.92, 0.99]	
		Tatal suggests	6350	15050	4010	30313	0.070	0.55 [0.52, 0.55]	1
		Iotal events	6259		4818				
		Heterogeneity: Not ap	plicable	-	-				
		Test for overall effect:	Z = 2.78	(P = 0.00)	(5)				
		Total (95% CI)	3	118504		88502	100.0%	0.61 [0.55, 0.68]	•
		Total events	20631		18244				N
		Heterogeneity: Tau <sup>2</sup> =	0.05; Chi	<sup>2</sup> = 598.2	23, df = 24 (	P < 0.000	01); I <sup>2</sup> = 96%		
		Test for overall effect:	Z = 8.75	(P < 0.00)	001)			nr	no DRM 🔰 noct DRM
		Test for subgroup diff	erences: C	$hi^2 = 43$	51. $df = 4.0$	P < 0.0000	$(01), 1^2 = 90.8$	%	
		rest for subgroup unit	contracts to						

Abdominal( Pediatric, obstetrics

## Total no. of complications

	a contra N	PBM	Control (pr	re-PBM)		Risk Ratio	Risk Ratio	Study or Sub
	Study or Su Youp	Events To	tal Events	Total	weight	M-H, Kandom, 95% CI	M-H, Kandom, 95% CI	
ortho	pedic 🔉	ery 12 2	1.4 5	120	0.7%	1 55 [0 56 4 20]		ortho
	Rineau 201	14 1	83 11	136	1.2%	1.28 [0.60, 2.74]		Kenneldis 30
	Kopanidis 2016	17 1	00 16	100	1.7%	1.06 [0.57, 1.98]		Kopaniois 20
	Loftus 2016	2954 65	93 3694	5997	8.8%	0.73 [0.70, 0.75]		Freedman 20
	Holt 2016	5 10	10 13	1814	0.7%	0.69 [0.25, 1.93]		Ma 2014
	Freedman 2008	23 11	27 41	1089	2.3%	0.54 [0.33, 0.90]		Theusinger 2
	Ma 2014	5	33 3	37	0.4%	1.87 [0.48, 7.22]		Meybohm 20
	Albinarrate 2015	32 3	57 39	271	2.8%	0.62 [0.40, 0.97]		Leaby 2017
	Frew 2016	36 4	06 97	717	3.6%	0.66 [0.46, 0.94]		Subtotal (95)
	Meybonm 2016	599 162	98 404 13 266	7282	6.6%	1.00 [0.89, 1.13]	-	Heterogeneit
	Subtotal (95% CI)	347	34 200	30262	36.5%	0.78 [0.66, 0.92]		Heterogeneic
	Total events	3901	4649		2012/1	and faired area!	•	Test for over-
	Heterogeneity: Tau <sup>2</sup>	= 0.03; Chi <sup>2</sup> = 3	7.62, df = 10 (F	<pre>&lt; 0.0001);</pre>	$ ^2 = 739$	6		
	Test for overall effect	t: Z = 2.96 (P = 0	0.003)					car
<b>.</b>	- \							Freedman 20
cardio	diac surgery	7						Brevig 2009
	reedman 2008	16 2	75 30	274	1.9%	0.53 [0.30, 0.95]		Censs 2015
	Brevig 2009	54 4	79 77	530	4.1%	0.78 [0.56, 1.07]		Mauhahan 20
	Moskowitz 2010	91 5	86 178	586	5.7%	0.51 [0.41, 0.64]	÷	Meybonn 20
	Meybohm 2016	813 79	/o 40 04 618	5630	4.2% 8.0%	0.05 [0.47, 0.09]		Leany 2017
	Leahy 2017	86 9	49 69	750	4.4%	0.99 [0.73, 1.33]	-	Suprotal (33)
	Subtotal (95% CI)	124	58	8157	28.3%	0.73 [0.56, 0.94]	•	Heterogeneit
	Total events	1224	1015					Test for over
	Heterogeneity: Tau <sup>2</sup>	= 0.08; Chi <sup>2</sup> = 2	9.54, df = 5 (P	< 0.0001); I	<sup>2</sup> = 83%			1/260
	Test for overall effec	t: $Z = 2.46 (P = 0)$	).01)					Vasc
								Freedman 20
vascula	whohm 2016	y 541 58	78 404	4177	7.7%	0.82 (0.72, 0.92)	-	Meybohm 20
	Leaby 2017	72 11	20 494 55 70	986	4 2%	0.88 [0.64 1.21]		Looks 2017
	Subtotal (95% CI)	69	83	5363	11.9%	0.83 [0.74, 0.92]	•	Subtotal (95)
	Total events	613	564				-	Subtotal (95
	Heterogeneity: Tau <sup>2</sup>	= 0.00; Chi <sup>2</sup> = 0.	14, df = 1 (P =	0.70); I <sup>2</sup> =	0%			Heterogeneit
	Test for overall effec	t: Z = 3.39 (P = 0	).0007)					Test for over
								gon
general	Seneral surgery	740 100		0164	7.00	0.04/0.75.0.031	_	gen
Seneral	Meybohm 2016	748 130	94 597 26 313	9164	7.9% 6.6%	0.84 [0.76, 0.93]	1	Meybohm 20
	Subtotal (95% CI)	174	30 213	12532	14.5%	0.90 [0.76, 1.06]	•	Leahy 2017
	Total events	983	810				1	Subtotal (95)
	Heterogeneity: Tau <sup>2</sup>	= 0.01; Chi <sup>2</sup> = 2.	.60, df = 1 (P =	$(0.11);  ^2 =$	62%			Hatasaasaih
	Test for overall effec	t: Z = 1.28 (P = 0	0.20)					Heterogeneit
- + 4	-							Test for over
otner	der fields							
	Meybohm 2016	4348 498	56 3465	36513	8.7%	0.92 [0.88, 0.96]	1	oth
	Total quants	4240	2465	20212	0.779	0.35 [0.66, 0.30]	1	Methodinit Fo
	Heterogeneity: Not a	nolicable	2402					Subtotal (95)
	Test for overall effec	t: Z = 3.89 (P < 0	0.0001)					Heterogeneity
								Test for over
	Total (95% CI)	1214	71	92827	100.0%	0.80 [0.74, 0.88]	•	resctor over
	Total events	11069	10503					Total (95% C
	Heterogeneity: Tau <sup>2</sup>	= 0.02; Chi <sup>2</sup> = 14	43.08, df = 21	(P < 0.0000	1)-16-6			
	Test for subgroup di	L = 9.75 (P < 0) (for an case of bil 2 -	8.64 df = 4 /P	= 0.070 12	_	pre PBI	/I 📝 pos	
	reactor soughoup of	merences. em. =	9.94, 91 = 4 (F	- v.v/), [	-			Test for overa
							r -	Tort for ruba

## Number of units per patients

orthopedic		SD	Total	Mean	SD	Total	Wainht	IV Random QS% [1]	IV Random 95% Cl
orthopedic						. oran	weight	14, Random, 3376 CI	IV, Kandom, 55% Cr
Kannaidir 2016 3		$\geq$	100			122		0.351.0.57.0.07	
	1/	3.04	190	10.0	1.0	127	4.0%	-0.25 [-0.57, 0.07]	
Kopaniais 2010 3	.120	2.04	100	2.05	1.1	100	3.4%	1.11 [0.66, 1.56]	
Preedman 2008 0	.34	0.83	1127	0.51	1.04	1089	0.7%	-0.17 [-0.25, -0.09]	
Ma 2014 0	.24	0.83	53	0.81	1.28	37	3.1%	-0.57 [-1.07, -0.07]	
Theusinger 2014 0	.34	1.25	6721	0.68	1.68	2150	0.7%	-0.34 [-0.42, -0.26]	7
Meybohm 2016 1	.24	0.10	10298	1.40	0.16	12033	0.9%	-0.22 [-0.22, -0.22]	S.,
Leahy 2017 0 Subtotal (05% CD	.16	0.75	11942	0.27	1.02	10304	5.9%	-0.11 [-0.13, -0.09]	
Subtotal (95% CI)			30411			20440	30.37	-0.18 [-0.26, -0.09]	
Heterogeneity: Tau* = 0.0	01; C	h(* = )	125.65, d	= 0 (P -	< 0.000	01); (* =	95%		
Test for overall effect: 7	- 4,1	4 (P <	0.0001)						
cardio	$\mathbf{i}$								
Erradman 2008	he	2.02	375	2.01	2.7	274	3.44	-0.851-1.25 -0.451	
Brevin 2000	53	1.83	673	1.43	3.08	520	3.0%	-0.03[-1.23, -0.43]	
Cross 2015 0	61	1.67	2276	1.39	2.14	397	5 414	-0.50[-1.61, -0.59]	
Mauhohm 2016 3	58	0.46	7004	4.65	0.46	5630	5.04	-0.07[-0.91, -0.43]	
Meyoonni 2010 3	.00	3.15	1431	1.45	3.67	1006	6.3%	-0.97 [-0.99, -0.95]	<u></u>
Subtotal (95% CD	.0.2	6-12	12364	1.40	3.07	7917	26.1%	-0.87 [-1.00, -0.74]	<b>A</b>
Hateronanaitic Taul - 0.0	11.0	hii - 1	102 46-	4/0 - 0	ADI-1	- 5/94	E.G.L.M	-0.01 [-1.00] -0.14]	
Test for overall effect:	. 12	01 /P	< 0.00001	416 6	1999 F.	- 30%			
Test for overall effects	( *** ·	94 U .	< 0.0000						
vascular	$\geq$								
Erredman 2008	75	1.82	212	2.12	4 19	287	2.0%	-0.37 (-1.08, 0.34)	
Meyhohm 2016 3	77	0.52	5823	4.9	0.51	4377	6.9%	-1 13 (-1 15 -1 11)	
Leahy 2017 0	18	1.51	1870	0.77	2.43	1760	6.4%	-0.39[-0.52, -0.26]	
Subtotal (95% CI)	1.1.90		7925	1010		6424	15.2%	-0.66 [-1.29, -0.04]	
Heterogeneity: $Tau^2 = 0.3$	27: C	$hl^2 = 1$	121.12. d	= 2 (P	< 0.000	01): I <sup>2</sup> =	98%		
Test for overall effect:	2.0	8 (P =	0.04)		1.007-00				
gonoral	/								
general									
Meybohm 2016 2	.09	0.16	13694	2.39	0.16	9164	6.9%	-0.30 [-0.30, -0.30]	*
Leahy 2017 0	.31	1.59	5437	0.49	2.17	4512	6.7%	-0.18 [-0.26, -0.10]	
Subtotal (95% CI)		1996224	19131	1867	1201200	13676	13.6%	-0.25 [-0.36, -0.13]	•
Heterogeneity: Tau <sup>2</sup> = 0.6	01; C	$hi^2 = 5$	9.52, df =	1 (P = 0)	.002); (	2 = 89%			
Test for overall effect: Z	= 4.1	3 (P <	0.0001)	11/2/25					
other		207							
meynomin corr	1	4.8	49856	1.7	5.6	36513	6.7%	-0.20 [-0.27, -0.13]	-
Subtotal (95% CI)			49856			36513	6.7%	-0.20 [-0.27, -0.13]	•
Heterogeneity: Not applic	able								12
Test for overall effect: Z =	= 5.5	0 (P <	0.00001)						
Total (95% CI)			125687			90970	100.0%	-0.43 [-0.54, -0.31]	
Heterogeneity: Tau' = 0.0	05; C	ni" = )	15280.28	df = 17	(P < 0)	00001);	l' = 1009	6	
Test for overall effect: Z =	7.0	8 (P <	0.00001)	- 1999-			122201		nre PRM 🔰 nost PRM

### Length of hospital stay

			PBM		Contro	ol (pre-	PBM)	r	Mean Difference	Mean Difference
N	Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	IV, Random, 95% CI
\	Orthopedic surg	erv								
nopeaic	Rineau 2016	9.28	2.7	183	9.35	2.5	184	6.7%	-0.07 [-0.60, 0.46]	
/	Loftus 2016	3.02	1.76	6593	3.32	1.91	5997	12.7%	-0.30 [-0.36, -0.24]	
•	Freedman 2008	6.25	18.2	1127	7.16	7.51	1089	2.4%	-0.91 [-2.06, 0.24]	
	Ma 2014	12.4	1.2	33	13.2	1.5	37	5.6%	-0.80 [-1.43, -0.17]	
	Albinarrate 2015	9.1	3.8	357	10.1	3.8	271	5.9%	-1.00 [-1.60, -0.40]	
	Meybohm 2016	12.85	16.3	16298	12.98	16.03	12633	8.8%	-0.13 [-0.51, 0.25]	-+
	Leahy 2017	5.89	8.74	11942	6.39	8.86	10304	10.9%	-0.50 [-0.73, -0.27]	
	Subtotal (95% CI)	A-1-120-12		36533			30515	52.9%	-0.41 [-0.60, -0.22]	
	Heterogeneity: Tau* -	= 0.03; C	$hi^2 = 12$	.66, df =	6 (P = (	2.05); 1*	= 53%			
	Test for overall effect	Z = 4.1	16 (P < 0)	.0001)						
ardio	Cardiac surgery	r.								
	Ereedman 2008	7.81	755	275	10.78	10.4	274	1.5%	-7 97 [-4 49 -1 45]	
V	Gross 2015	10.4	8	2275	12.2	9.6	387	3.0%	-1.80 [-2.81, -0.79]	
	Meybohm 2016	16.6	19.4	7904	16.95	19.8	5630	5.2%	-0.35 [-1.02 0.32]	
	Leahy 2017	11.07	11.64	1431	11.9	11.74	1096	3.4%	-0.83 [-1.75, 0.09]	
	Subtotal (95% CI)			11885			7387	13.1%	-1.34 [-2.34, -0.34]	
	Heterogeneity: Tau <sup>2</sup> -	- 0.77: 0	$hi^2 = 12$	.58, df =	3 (P = (	0.006); 1	$^{2} = 76\%$			
	Test for overall effect	: Z = 2.6	3 (P = 0)	.009)		000000000				
$ \longrightarrow $										
iscular 🔾	Vascular surger	y								
	Freedman 2008	8.07	23.4	232	12.91	27.5	287	0.2%	-4.84 [-9.22, -0.46]	•
V	Meybohm 2016	18.13	25.1	5828	18.68	24.98	4377	3.1%	-0.55 [-1.53, 0.43]	
	Leahy 2017	9.16	12.91	1870	9.9	13.02	1760	3.9%	-0.74 [-1.58, 0.10]	
	Subtotal (55% Cl)	0.21.0	1.1 - 2.1	1930	0 - 0	17.1	438	1.2.70	-0.03 [-1.03, 0.13]	
	Test for overall effect	Z = 1.7	10 (P = 0)	.09)	(P = 0)	177,10 -	4.370			
	rest for oreran circo									
eneral 🔿	General surgery									S Commentaria Comp
	Meybohm 2016	14.38	21.33	13694	14.58	19.58	9164	6.6%	-0.20 [-0.74, 0.34]	
·	Leahy 2017	6.97	10.06	5437	6.49	8.79	4512	8.9%	0.48 [0.11, 0.85]	
	Subtotal (95% CI)	3-02	12 12	19131	0.01 10.00		13676	15.5%	0.17 [~0.50, 0.83]	-
	Heterogeneity: Tau* +	= 0.18; C	$hi^2 = 4$ .	17, df = 1	(P = 0)	04); 1' =	76%			
N	Test for overall effect	: Z = 0.5	0 (P = 0)	.62)						
thar	Other fields									
otner /	Meybohm 2016	10.7	14.1	49856	11.1	14.6	36513	11.4%	-0.401-0.590.211	
	Subtotal (95% CI)			49856		11.0	36513	11.4%	-0.40 [-0.59, -0.21]	•
	Heterogeneity: Not an	plicable								
	Test for overall effect	Z = 4.0	(P < 0)	.0001)						
	Tatal (DEW CD							100.00	0.451.055.0351	
	Total (95% CI)	0.00		125335	10.00	0.0000	94515	100.0%	-0.45 [-0.65, -0.25]	
	Test for quarall effect	- 0.08; 0	$m^{-} = 57$	000011	10 (b <	0.0000	1); F = 1	2.75		-4 -2 0 2 4
	the second			A REAL PROPERTY OF A REAL PROPER						

## What is anemia?

- Hgb < 130g/L m
- Hgb <120 g/| F\*
- Mild to moderate: 100-129 g/L
- Moderate to severe: <100 g/L
- ANEMIA means low O<sub>2</sub> carrying capacity AND inability to meet body physiological needs for quantity of O<sub>2</sub> of the tissues
- WHO (1968-2011)





# *Eur. J Anesthesiology 2017; 34: 332-395*

• If anemia is present, we recommend identifying the cause. **1C** 

## holly trinity of anemia

- Iron deficiency
- Renal disease
- Chronic inflammation

## PREOPERATIVE : SCREENING OF ANEMIA

## Laboratory Tests

- Complete Blood Cell Count
- Iron Status (Iron, Ferritin, Transferrin saturation)
- Serum sol transferrin receptors –ferritin index
  - (<1>2)
- Inflamation Marker
- Vitamin B12, Folic Acid (>65 years old)



Society of Thoracic Surgeons Blood Conservation Guideline Task ForceFerraris VA, Ferraris SP, Saha SP, et al. Perioperative blood transfusion and blood conservation in cardiac surgery: the Society of Thoracic Surgeons and The Society of Cardiovascular Anesthesiologists clinical practice guideline. Ann Thorac Surg 2007; 83(5Suppl): \$27–86

### Review Article

## Diagnosis

### Pre-operative haematological assessment in patients scheduled for major surgery

M. Muñoz,<sup>1</sup> S. Gómez-Ramírez<sup>2</sup> and S. Kozek-Langeneker<sup>3</sup>

Professor, Peri-operative Transfusion Medicine, School of Medicine, University of Málaga, Málaga, Spain
 Consultant, Department of Internal Medicine, Xanit International Hospital, Benalmádena, Spain
 Professor, Department of Anaesthesia and Intensive Care, Evangelical Hospital, Vienna, Austria

#### Summary

Peri-operative anaemia, blood loss and allogeneic blood transfusion are associated with increased postoperative morbidity and mortality, and prolonged hospital stay. A multidisciplinary, multimodal, individualised strategy, collectively termed 'patient blood management', may reduce or eliminate allogeneic blood transfusion and improve outcomes. This approach has three objectives: the detection and treatment of peri-operative anaemia; the reduction of peri-operative bleeding and coagulopathy; and harnessing and optimising the physiological tolerance of anaemia. This review focuses on the pre-operative evaluation of erythropoiesis, coagulation status and platelet function. Where possible, evidence is graded systematically and recommended therapies follow recently published consensus guidance.

- HgB, MCV
- Serum iron-TIBC
- Serum ferritin ( 30-100micg/L)- most specific
- Transferrin saturation(TSAT) (20%)
- Serum soluble transferrin receptors (sTRF)(<2,4,5)
- (not affected by inflammation)
- Serum sol transferrin receptpors –ferritin index (<1>2)
- Ferritin (Inflamat <100; CHF <300; CKD<500, cancer <800) Tsat <20%

Munoz M,. Anesthesiology 2016,71 (supl 1), 19-28



## **FE Metabolism basics**

Iron, transferrin should be bounded

Fe, from nutrition or recycled

functional pool (heart, muscles- non erythroid, bone marrow, RBC); storage pool (liver)

Fe, needed for RBC renewal 20-30 mg,1-2 mg absorbed- lost

Fe, Ferrous form transported through FEROPORTIN

## HEPCIDIN- PEPTIDE (HEPATOCITES – IN RESPONSE OF INLTAMATION) DYSREGULATES IRON

Anand IS. Circulation 2018;138:80-98



## Challenge is to implement anemia management pathways

BJA

British Journal of Anaesthesia 115 (1): 15–24 (2015)

**doi: 10.1093/bja/aev165** Review Articles

REVIEW ARTICLES

#### 'Fit to fly': overcoming barriers to preoperative haemoglobin optimization in surgical patients<sup>+</sup>

M. Muñoz<sup>1,\*</sup>, S. Gómez-Ramírez<sup>3</sup>, S. Kozek-Langeneker<sup>4</sup>, A. Shander<sup>5</sup>, T. Richards<sup>6</sup>, J. Pavía<sup>2</sup>, H. Kehlet<sup>7</sup>, A. G. Acheson<sup>8</sup>, C. Evans<sup>9</sup>, R. Raobaikady<sup>10</sup>, M. Javidroozi<sup>5</sup> and M. Auerbach<sup>11</sup>

BJA

British Journal of Anaesthesia 115 (1): 15-24 (2015)

doi: 10.1093/bja/aev165 Review Articles

#### REVIEW ARTICLES



#### 'Fit to fly': overcoming barriers to preoperative haemoglobin optimization in surgical patients<sup>+</sup>

M. Muñoz<sup>1,\*</sup>, S. Gómez-Ramírez<sup>3</sup>, S. Kozek-Langeneker<sup>4</sup>, A. Shander<sup>5</sup>, T. Richards<sup>6</sup>, J. Pavía<sup>2</sup>, H. Kehlet<sup>7</sup>, A. G. Acheson<sup>8</sup>, C. Evans<sup>9</sup>, R. Raobaikady<sup>10</sup>, M. Javidroozi<sup>5</sup> and M. Auerbach<sup>11</sup>



## Eur. J Anesthesiology 2017; 34: 332-395

- We recommend that patients at risk of bleeding are assessed for anemia 3 to 8 weeks before surgery. **1C**
- In non-cancer patients with preoperative anemia scheduled for elective major surgery, we recommend postponing surgery until anemia has been corrected. 1C

• Time Supporting hematopoiesis (iron, folic ESAS)

## **Red cell maturation**





## HELP us Celebrities

- Venus wiliams
- Selena Gomez
- Angelina Jolie
- Brittany Murphy



• Esa is in line with NATA

Eur. J Anesthesiology 2017; 34: 332-395

• We recommend treating iron deficiency with iron supplementation. **1B**-

• We recommend the use of intravenous iron in preference to oral iron. **1C**-

Munoz M Manegment of Preoperative anemia :NATA consensus statement ISBP Sci Ser 2012;7:283-287

Bruce et all Practical recommendation for patient blood manegment to reduce of perioperative transfusion in joint replacement



	Ferumoxytol	Iron Carboxymaltose	Iron Isomaltoside 1000	Low Molecular Weight Iron Dextran	Iron Sucrose	Iron Gluconate
Brand name	Feraheme®	Ferinject <sup>®</sup>	Monofer®	Cosmofer®	Venofer®	Ferlixit <sup>®</sup>
Maximum single dose	510 mg	1000 mg	20 mg/kg	20 mg/kg	200 mg	125 mg
Minimum administration time (minutes)	15	15	15	60	зо	30-60
Replacement dose possible in a single infusion	No	Yes	Yes	Yes	No	No

## **Oral Iron therapy**

Is cheep, takes >8 weeks

Pitfalls: not predictable, GI side effects, bioavailability is changed (H. Pillory)

Doses 40-60 mg /day, without food, interfered with drugs and minerals

Fe, Ferrous form- HAEM for is better choice

Hepcidin levels block it, controversies : does it rise its levels

Blood 2015: 126:1981-1989 Cochrane Library: database of systemic rewieves 2016

## **IV IRON THERAPY**

EXPENCIVE , BUT MORE EFFECTIVE

Decrease the need for ABT and mortality rates increases Hbg, degreases postop anemia

Novel preparations -without high molecular dextran's ,less- adverse effects

Benefits overcome risks

Recommended where time to surgery is short, no other treatment has results 1 B

Lancer Haematol 2018;5:310-20 PLOS ONE 2015: 10:E011783 Vox Sanguinis 2015;257-266 Transfusion 2014;54:113-1145

#### Pragmatic approach "global correction"

- 1 g isomaltosid IV
- + 40.000 U erythropoietin alpha s.c.
- + 1 mg/day vitamin B12 p.o.
- + 5 mg/day folate p.o.





Review

## Intravenous Irons: From Basic Science to Clinical Practice

Sunil Bhandari <sup>1</sup><sup>(1)</sup>, Dora I. A. Pereira <sup>2,3</sup>, Helen F. Chappell <sup>4</sup> and Hal Drakesmith <sup>5,6,\*</sup>

Pharmaceuticals 2018;11:82-89



### *Eur. J Anesthesiology 2017; 34: 332-395*

 If other causes of anemia have been excluded or treated
 we suggest erythropoiesis stimulating agents .

**2C** 

## Erythropoiesis stimulating agents

WHO list of essential medicines, in patient ACD (>500 ml blood lost), Hgb <13

Epoetin alpha, Darbeopetin, Erythropoietin biosimilars

Increases red cell mass

Reduces ABT, not in hypertensive , increases the risk for DVT, cancer

Controversies for to much still going on

Lancer Haematol 2018;5:310-20 Vox Sanguinis 2015;257-266



*Eur. J Anesthesiology 2017; 34: 332-395* 

 In patients with preoperative anemia, we recommend the use of combined therapy with intravenous iron and erythropoietin along with a restrictive transfusion policy. 1C

 If autologous blood donation is performed suggest treatment with Iv iron, ESA to avoid preoperative anemia and transfusion rates. 2C

## Anemia Treatment Safely increase Hgb 0.5-1 gm/week

- Treatment Options: IV iron, enteric iron, Erythropoietin stimulating agents (ESA's), Vitamin B-12, folate, treat co-morbidities, delay and defer
- IV iron, effect at 1 week, max effect at 2 weeks,
- several doses needed (1 gram divided dose common)
- ESA action onset 4-6 days, max at 10 days, must
- give with iron
- Pre- OP-One week treatment "lead time" needed, Post-OP start ASAP.

## Ultra short combination treatment, IV iron, B12, ESA

• Single dose intravenous iron for iron deficcency: new paradigm

Haemathology 2016

Fast track anemia clinic in the Emergency department

*Blood Transfusions 2016;14;126-133* 

Effect of ultra short term treatment of patients with iron deficiency anemia or anemia undergoing cardiac surgery a prospective trial

Lancet 2019 393;2201-2212

## • Perioperative

## • Fluid management

- *T*
- *Ph*
- Prolene
- Cell salvage
- Antifibrinolytics

## Postoperative anemia



Eur. J Anesthesiology 2017; 34: 332-395

• If patients are anemic following surgery we suggest use of intravenous iron post op. **2C** 

# • Postoperative anemia

### *Eur. J Anesthesiology 2017; 34: 332-395*

• Hemolysis,

- Blood loss, low EPO stores,
- Hepcidin levels,
- Nutritional or
- Hemodilution

# • Postoperative anemia

### EBM reccomendation

## • Ferritin levels

• Insufficient Iron stores and Ferritin <100

• We recommend a target Hb of 7-9 g/dl during active bleeding.**1C** 

	Restrictive transfusion criteria's for postoperativ	e bleeding
Hb level (g/dl)	<ul> <li>• ability to compensate anaemia?</li> <li>• signs of hypoxia?</li> <li>• risk factors: comorbidity?</li> <li>• relevant postOP bleeding?</li> </ul>	Decision for pRBC transfusion
< 6		yes (1-2 pRBCs)
	compensation adequate no risk factors no relevant postOP bleeding	no
6 - 8	compensation recuded e.g. ST-segment dynamics, tachycardia > 80 bpm, hypotension, lactate acidosis risk factors present: e.g., CHD, cardiac failure, stroke, renal dysfunction	yes
	compensation adequate	no
8 - 10	compensation reduced: e.g. ST-segment dynamics, tachycardia > 80 bpm, hypotension, lactate acidosis	yes
> 10		no







 Total iron-binding capacity. The transferrin molecule binds free iron and transports it in the blood. Total iron-binding capacity (TIBC) or sometimes transferrin iron-binding capacity is a medical laboratory test that measures the blood's capacity to bind iron with transferrin.

## Transferrin saturation, measured as a percentage, is a medical laboratory value. It is the value of serum iron divided by the total iron-binding capacity. ... For instance, a value of 15% means that 15% of iron-binding sites of transferrin are being occupied by iron. The three results are usually reported together.

## Blood transfusion overuse

- World health Organisation resolution in 2012 identified patient blood management as one of the most important issues in the care of surgical patients worldwide
- WHO 2010 RECOGNIZED PBM AS A MEANS TO promote the avialiability of transfusion alternatives
- Htttp??apps.who.int ebwha