South East Coast Regional Transfusion Committee Free Education Symposium
& Business Meeting
Post Graduate Education Centre, East Surrey Hospital
21st February 2018

'Optimising the Pre-Operative Patient'

Avoidance and alternatives to transfusion in Surgery

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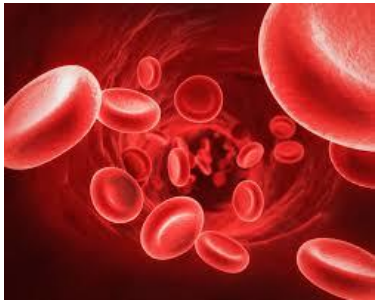
Reasons for avoidance

- Patient blood management
- Personal preferences
- Rare blood groups
- Allosensitization of rare RBC



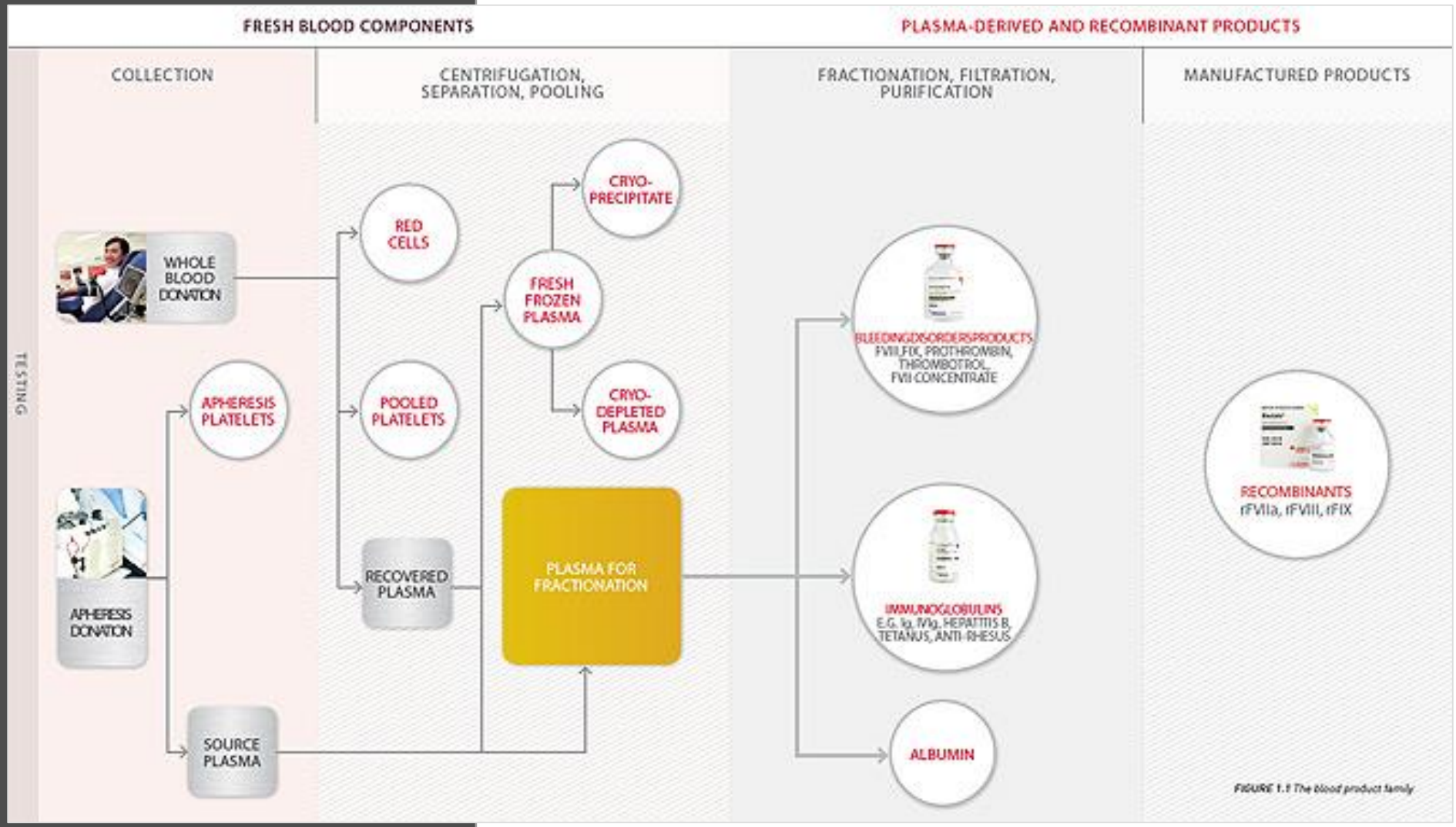


FIGURE 1.1 The blood product family

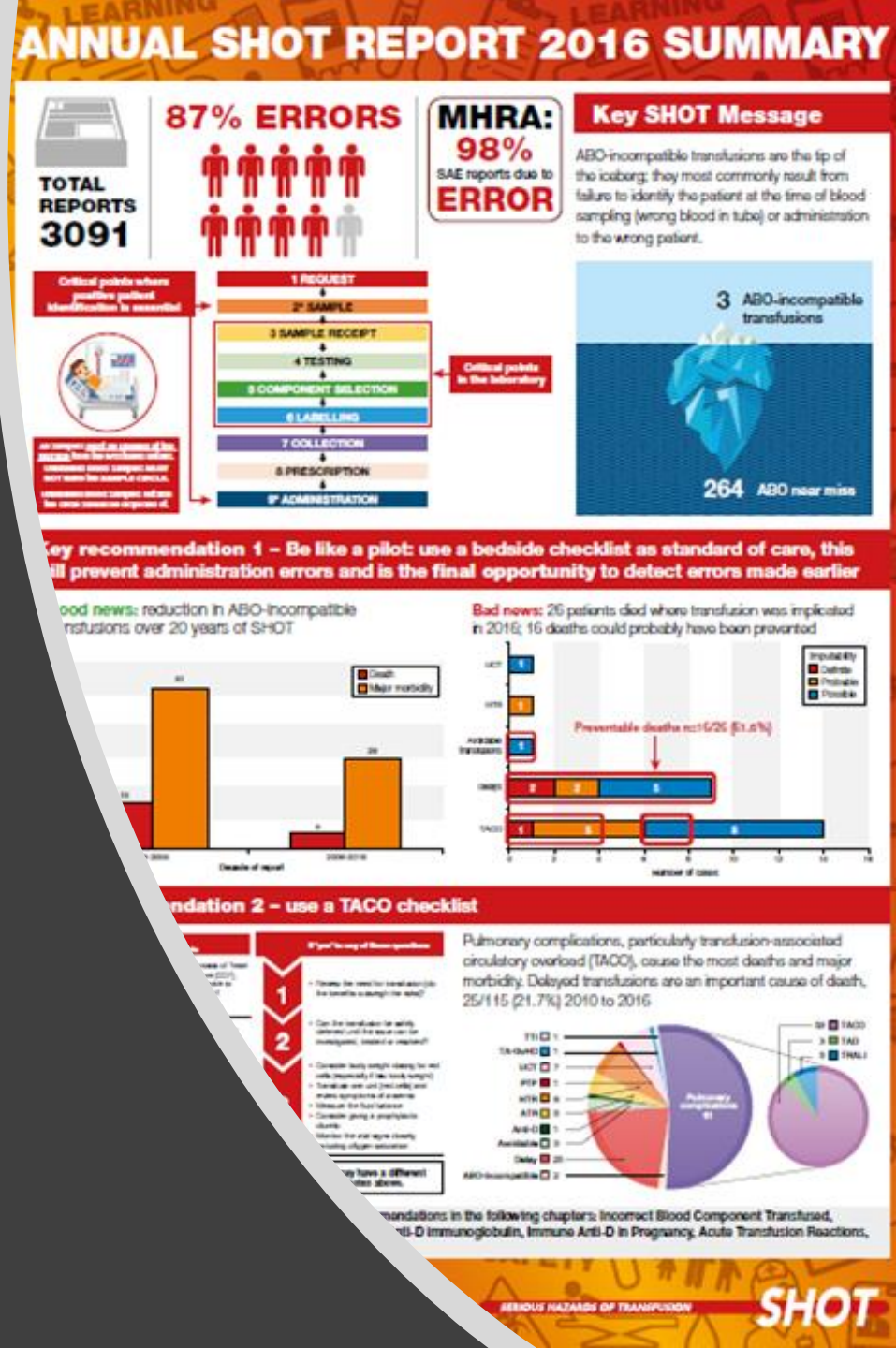
Risks

'…Hepatitis B…1 in 1.3 million blood donations…..you are more likely to die in a gas incident (fire, explosion or carbon monoxide poisoning) than to get hepatitis….HIV (1 in 6.5 million) and hepatitis C (1 in 28 million)… variant Creutzfeldt-Jakob Disease (vCJD) 2.5 million units of blood components are transfused…a handful of cases where patients are known to have become infected with vCJD…'.

http://hospital.blood.co.uk/patient-services/patient-blood-management/patient-information-leaflets/

Risks

https://www.shotuk.org/wp-content/uploads/SHOT-Report-2016-Summary.pdf



Costs

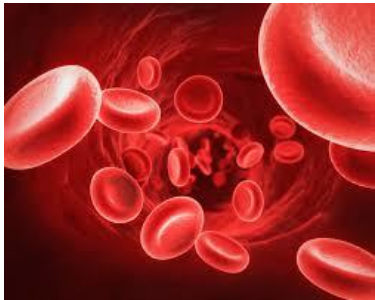
http://hospital.blood.co.uk/media/29056/price_list_bc_nhs_2017-18.pdf

product	Cost £
PRC	124.46
O-ve	129.41
Plt	178.19
FFP	28.46
Cryo	177.55

Haemoglobin levels & mortality levels

- Nadir 70-80

Shander A et al. An update on mortality and morbidity in patients with very low postoperative hemoglobin levels who decline blood transfusion (CME). Transfusion 2014;54:2688-2695

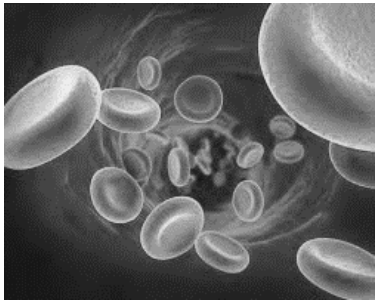


Haemoglobin substitutes

Human & bovine blood, Hb removed, Sterilisation and stabilising, Resuspending

1. Hb based O2 carriers
   Cell free (human & bovine Hb)
2. Perfluorocarbons
   Fluoride substituted linear or cyclic carbon chains with high O2 capacity
3. Liposome encapsulated Hb

- A Review of Blood Substitutes: Examining The History, Clinical Trial Results, and Ethics of Hemoglobin-Based Oxygen Carriers. Chen et al Clinics (Sao Paulo). 2009 Aug; 64(8): 803–813. doi: 10.1590/S1807-59322009000800016
- Hemoglobin substitutes Anbari et al Eur Spine J. 2004 Oct; 13 (Suppl 1): S76–S82. doi: 10.1007/s00586-004-0737-x
- Experience with the use of Hemopure in the care of a massively burned adult Lundy et al Int J Burns Trauma. 2014; 4(1): 45–48.



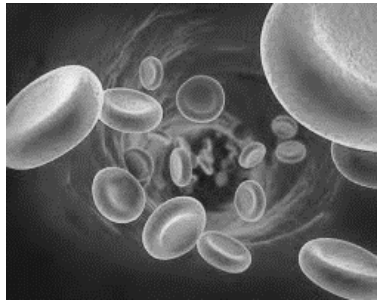
Haemoglobin substitutes

Potential benefits

- Avoids/ limits donated blood
- Countries where safety of donated blood is insecure
- Mass casualty situations
- Increase MAP
- No X match needed
- Long storage
- Stored at room temp
- Bridge until own erythropoiesis recovers

Issues

- Data from studies incomplete studies
- Lasts 18-60 h in body
- Low affinity for O2
- Acts like a colloid
- Studies vs HES, HES now discredited
- Vasoconstriction
- Increase mortality
- No reduction in amt of blood used
- Incr serum urea, AST, ALT (jaundice)
- No FDA approval



Haemoglobin substitutes

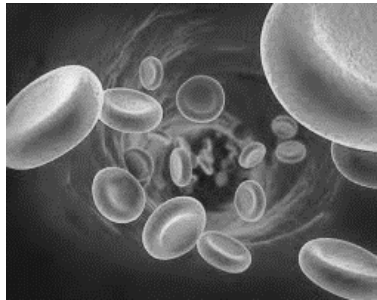
- HemAssit (Human Hb)
- PolyHeme (? Hb)
- Hemopure incl HBOC-201 (Bovine Hb) HBOC 301-oxyglobulin-veterinairy use

Newer

- Hemotech (Bovine Hb)
- Hemospan (Human Hb)
- Oxy-0301 (? Hb)

Balance

- Science
- Business
- Ethical



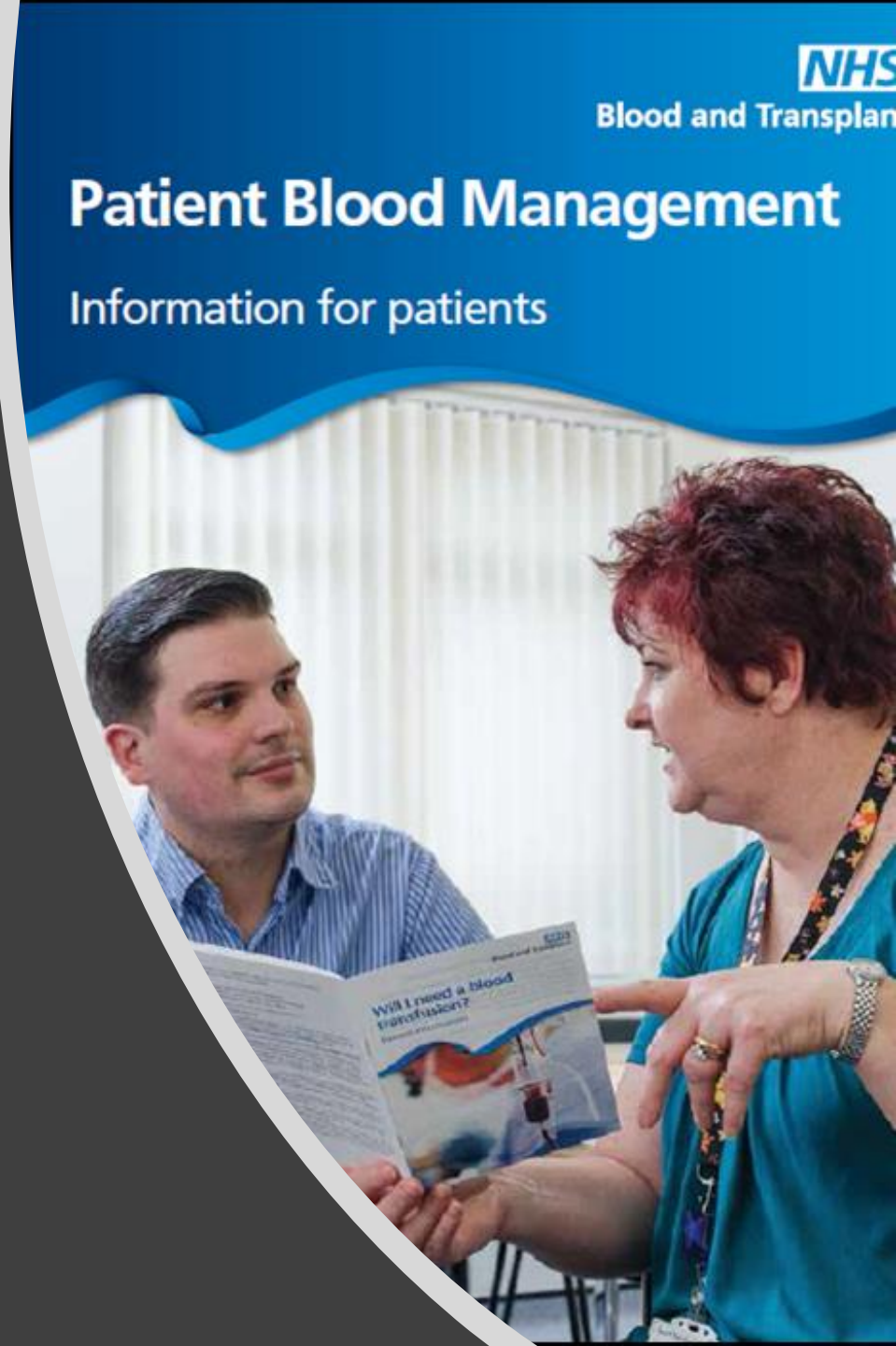
Oxygen delivery=Hb x SaO_2 x CO x constant

Hb level vs Rate of blood loss vs Clotting

Patient blood management

‘…a standard of care that focuses on measures to reduce or avoid the need for a blood transfusion if possible. However, if a transfusion is needed, PBM makes sure that patients are given only what they really need and that the transfusion is given safely.’

http://hospital.blood.co.uk/patient-services/patient-blood-management/patient-information-leaflets/



3 Cases

Case 1
30 y o F for mastectomy for breast ca

Case 2
35 y o F myomectomies to help with fertility

Case 3
27 y o F LSCS for placenta acreta

Case 1
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Cancer nurse specialist said

‘It’s NOT the role of the Cancer MDT to check Hb’

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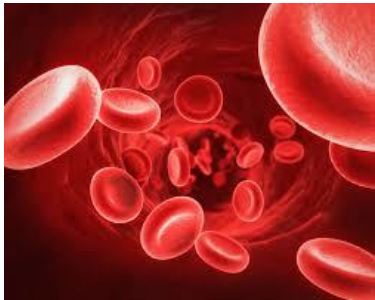
Oxygen delivery=Hb x SaO_2 x CO x constant

Hb level vs Rate of blood loss vs Clotting

Pre-operative Hb levels

- Transfusion
- Length of stay

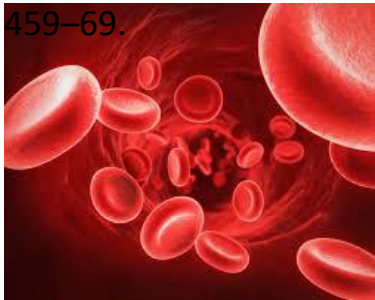
- Effect of a patient blood management programme on preoperative anaemia, transfusion rate, and outcome after primary hip or knee arthroplasty: a quality improvement cycle. Kotze A et al Br J Anaesth. 2012 Jun;108(6):943-52. doi: 10.1093/bja/aes135



Pre-operative

- Hb 13
- Anaemia
- Iron stores
- Early ID and early Tx

- International consensus statement on the peri-operative management of anaemia and iron deficiency. Muñoz, M. et al (2017), Anaesthesia, 72: 233–247. doi:10.1111/anae.13773
- Blood use in elective surgery: the Austrian benchmark study. Gombotz H et al. Transfusion 2007; **47**: 1468–80.
- Orthopedic surgery transfusion hemoglobin European overview (OSTHEO) study: blood management in elective knee and hip arthroplasty in Europe. Rosencher N et al Transfusion 2003; **43**: 459–69.



Post operative Transfusion triggers

Table 2. Hemoglobin Levels and Transfusions.*

Variable	Liberal Strategy (N=1007)	Restrictive Strategy (N=1009)	P Value
Hemoglobin level — g/dl			
Before surgery	11.3±1.5	11.3±1.5	0.70
During eligibility screening	9.0±0.8	9.0±0.8	0.98
Before transfusion	9.2±0.5	7.9±0.6	<0.001
Estimated blood loss during surgery — ml†	209±179	232±257	0.03
Transfusions before randomization			
0 units — no./total no. (%)	754/1006 (75.0)	720/1008 (71.4)	
≥1 unit — no./total no. (%)	252/1006 (25.0)	288/1008 (28.6)	0.07
Total no. of units	452	531	
Transfusions after randomization			
0 units — no./total no. (%)	33/1003 (3.3)	594/1007 (59.0)	
1 unit — no./total no. (%)	420/1003 (41.9)	246/1007 (24.4)	
2 units — no./total no. (%)	346/1003 (34.5)	127/1007 (12.6)	
3 units — no./total no. (%)	132/1003 (13.2)	24/1007 (2.4)	
≥4 units — no./total no. (%)	72/1003 (7.2)	16/1007 (1.6)	<0.001
Total no. of units	1866	652	
Storage of units transfused after randomization — days‡	22.0±9.5	22.1±9.9	0.83
Leukoreduced units transfused after randomization — %§	90.2	88.6	0.25
Major protocol violation — no./total no. (%)¶	91/1006 (9.0)	56/1007 (5.6)	0.003
Transfusion because of symptoms — no./total no. (%)‖			
Rapid bleeding	5/1006 (0.5)	14/1007 (1.4)	0.04
Chest pain	4/1006 (0.4)	9/1007 (0.9)	0.17
Congestive heart failure	1/1006 (0.1)	10/1007 (1.0)	0.007
Tachycardia or hypotension	43/1006 (4.3)	123/1007 (12.2)	<0.001

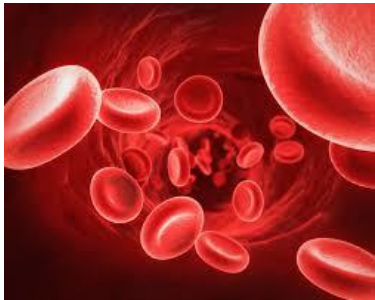
Carson JL et al. N Engl J Med 2011;365:2453-2462.

Post operative iron

- Ferrinject
  - I dose 1000 mg
  - weeks

- Intravenous ferric carboxymaltose versus standard care in the management of postoperative anaemia: a prospective, open-label, randomised controlled trial. Khalafallah et al Lancet Haematol. 2016 Sep;3(9):e415-25. doi: 10.1016/S2352-3026(16)30078-3.

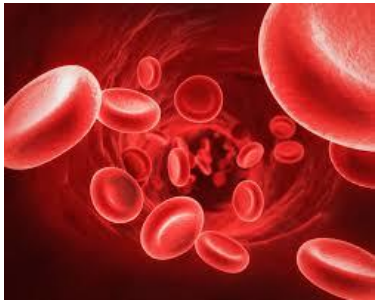
- Randomized trial comparing ferric carboxymaltose vs oral ferrous glycine sulphate for postoperative anaemia after total knee arthroplasty. Bisbe et al Br J Anaesth. 2014 Sep;113(3):402-9. doi: 10.1093/bja/aeu092.



Anaesthetic techniques

- Hypotensive anaesthesia
- Regional block
- Positioning
- Mechanical ventilation

- http://www.natao nline.com/np/434/ anesthetic-techniques-reduce-blood-loss



Avoiding hypothermia

- Decrease blood loss
- Decrease blood transfusion

- Aggressive Warming Reduces Blood Loss During Hip Arthroplasty Anesthesia & Analgesia: Winkler et al October 2000 - Volume 91 - Issue 4 - p 978–984 doi: 10.1097/00000539-200010000-00039
- tps://www.nice.org.uk/guidance/cg65/evidence/addendum-pdf-196802750
- Mild hypothermia increases blood loss and transfusion requirements during total hip arthroplasty Schmied et incl Sessler Vol 347, Issue 8997, 3 Feb 1996, P 289-292

Case 2
35 y o F myomectomies to help with fertility

Surgeon said

‘We just needed to get on with op’

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35 y o F myomectomies to help with fertility

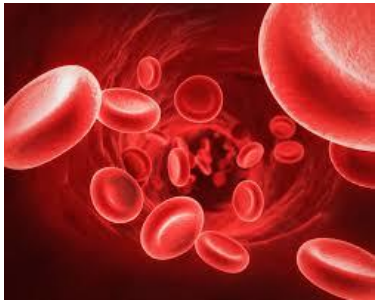
Oxygen delivery=Hb x SaO_2 x CO x constant

Hb level vs Rate of blood loss vs Clotting

Surgical or radiological intervention techniques

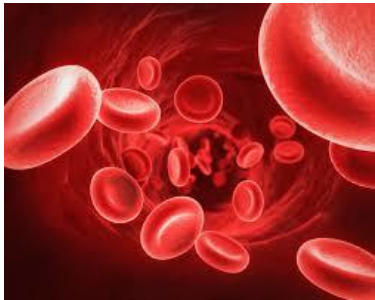
- Electrocautery
  - Water
  - Gas
  - Microwave
  - Laser
- Drains
- Laparoscopic incl pneumoperitoneum
- Tourniquet
- Interventional radiology

- http://nataonline.com/np/425/surgical-techniques-reduce-blood-loss

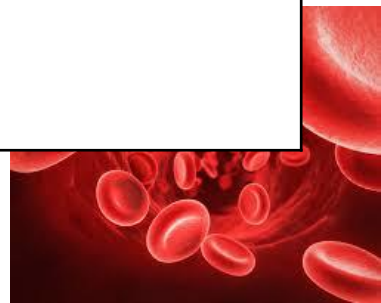


Erythro-poientin

- Dose



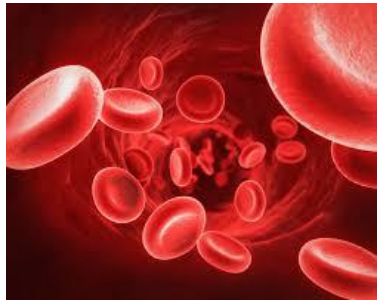
ESA	Licensed (non-renal) indications	Recommended dose
Epoietin alfa	Treatment of anaemia and reduction of transfusion in adult patients receiving chemoTx for solid tumours, lymphoma or myeloma	Initial dose sc: 150 IU/kg 3 times weekly or 450 IU/kg once weekly
	Preop autologous donation (of up to 4 U collected over 3 weeks)	600 IU/kg iv 2 times weekly for 3 weeks prior to surgery
	Prior to major orthopaedic surgery in adults	600 IU/kg sc on days –21, –14, –7 and day of surgery
Epoietin beta	Symptomatic anaemia in adult patients with non-myeloid malignancies receiving chemoTx	Initial dose sc 30 000 IU once weekly (approx 450 IU/kg)
	Preop autologous donation	2 times weekly for 4 weeks sc/iv SPC dosing algorithm
Darbopoietin alfa	Symptomatic anaemia in adult cancer patients with non-myeloid malignancies receiving chemoTx	Initial dose 500 mcg (6.75 mcg/kg) sc once every 3 week



Monitoring

- Continuous and noninvasive hemoglobin monitoring reduces red blood cell transfusion during neurosurgery: a prospective cohort study Wael N. Awada et al J Clin Monit Comput. 2015; 29(6): 733–740. doi: 10.1007/s10877-015-9660-4

- Blood clotting analysers (TEG or ROTEM) versus any comparison to guide the use of blood products in adults or children with bleeding http://www.cochrane.org/CD007871/ANAESTH_blood-clotting-analysers-teg-or-rotem-versus-any-comparison-guide-use-blood-products-adults-or



Tranexamic acid

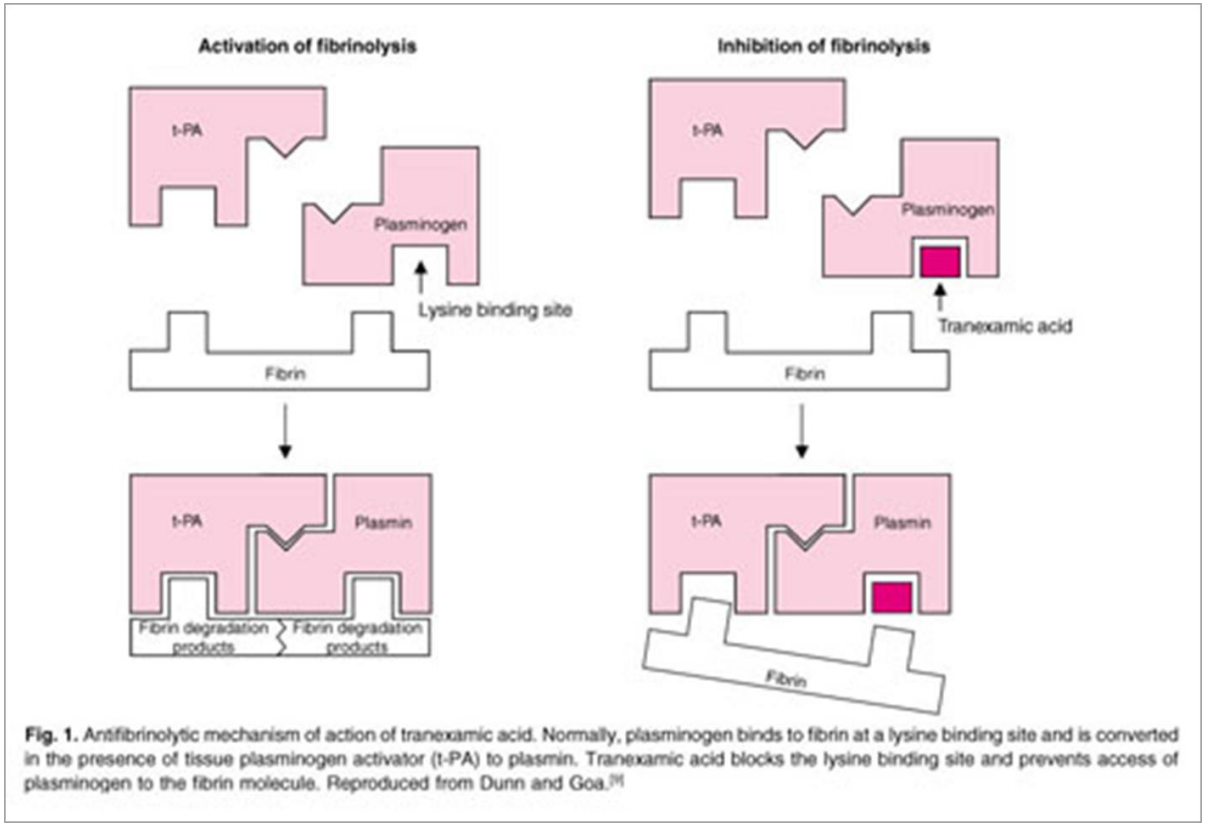
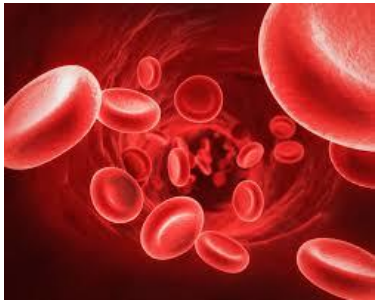


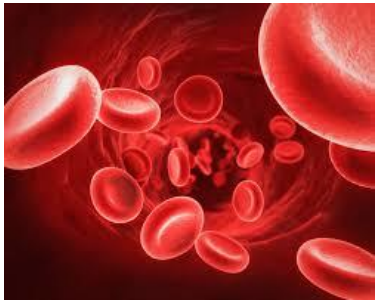
Fig. 1. Antifibrinolytic mechanism of action of tranexamic acid. Normally, plasminogen binds to fibrin at a lysine binding site and is converted in the presence of tissue plasminogen activator (t-PA) to plasmin. Tranexamic acid blocks the lysine binding site and prevents access of plasminogen to the fibrin molecule. Reproduced from Dunn and Goa.[9]



Tranexamic acid

	TXA group	Control group	
Receiving Bank/ own blood	7.7%	20.1%	P<0.01
VTE complications	0.6%	0.8%	
Other complication	1.9%	2.6%	
Renal failure	1.2	1.6	

- Tranexamic acid use and postoperative outcomes in patients undergoing total hip or knee arthroplasty in the United States: retrospective analysis of effectiveness and safety. Jashvant P et al.
BMJ 2014; 349 doi: https://doi.org/10.1136/bmj.g4829



Case 3
27 y o F LSCS for placenta acreta

Patient said

‘I just want to save as much of my own blood’

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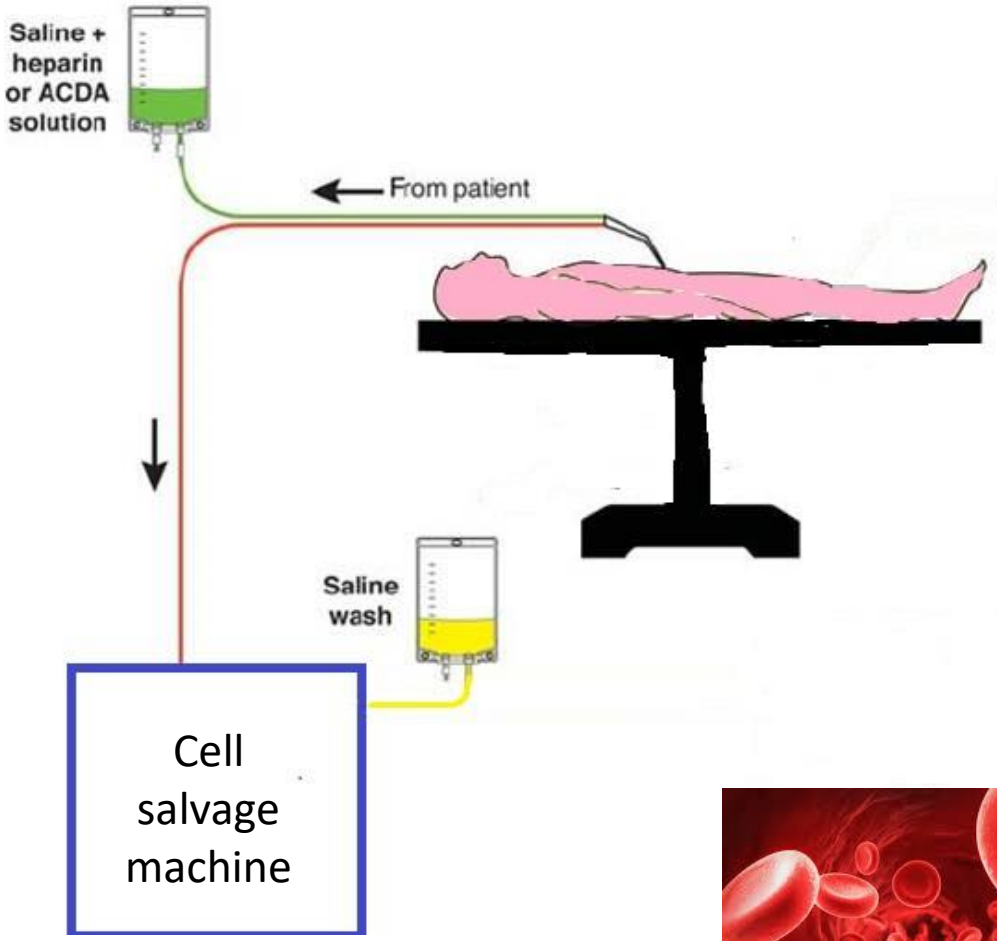
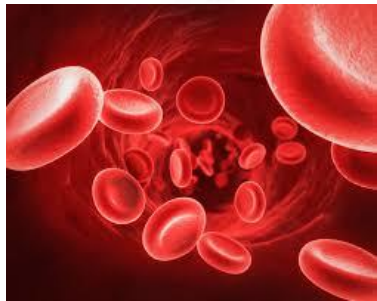
Oxygen delivery=Hb x SaO_2 x CO x constant

Hb level vs Rate of blood loss vs Clotting

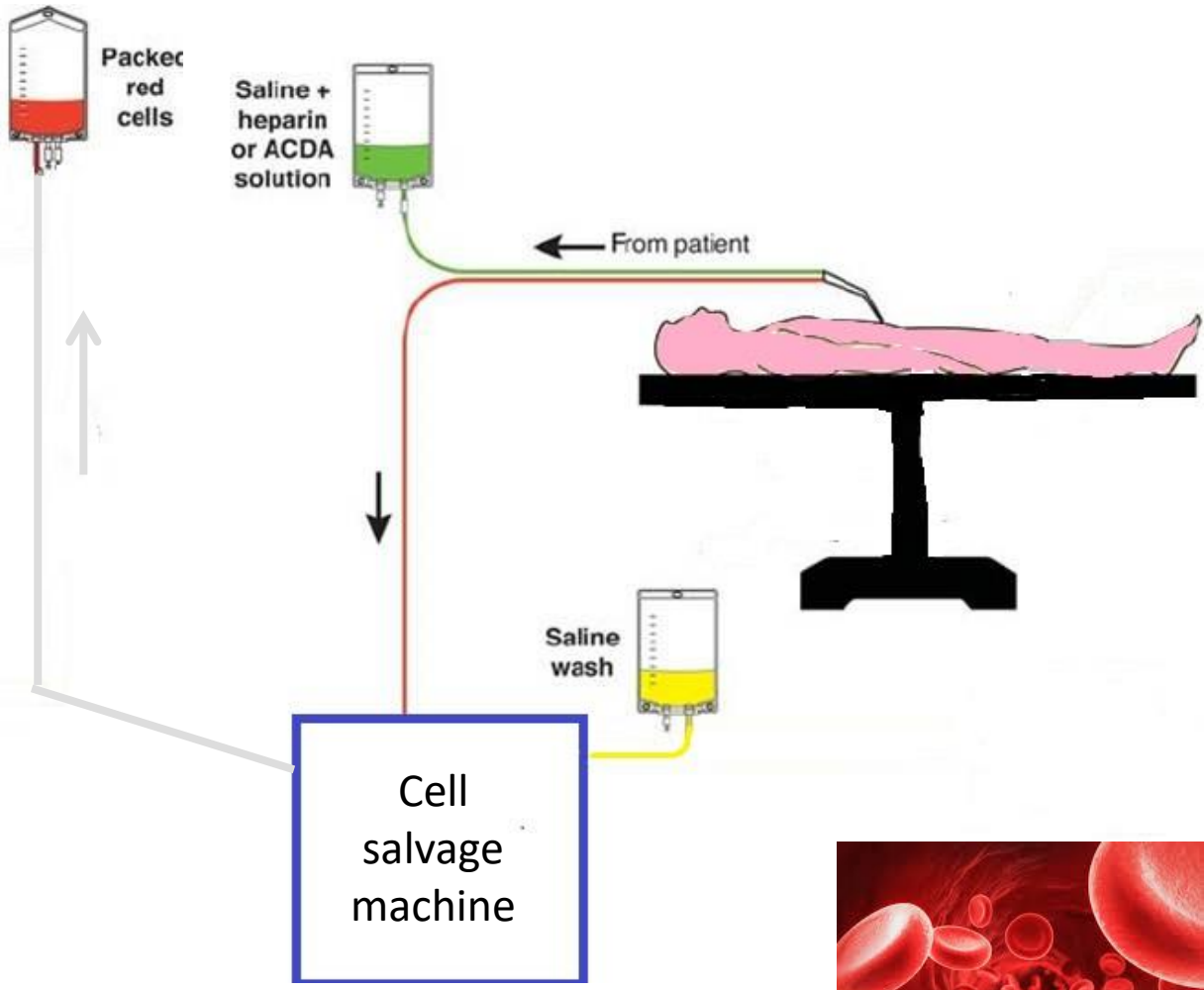
Cell salvage

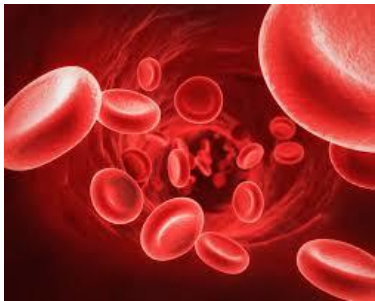
Cell salvage-collect



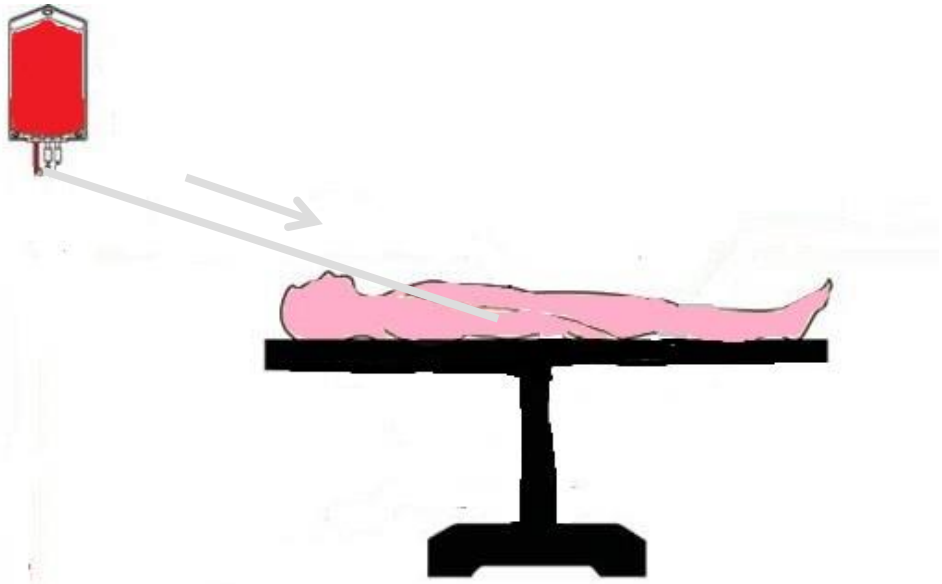


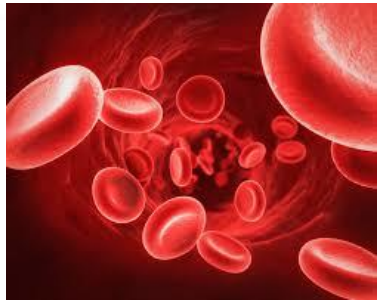
Cell salvage-process



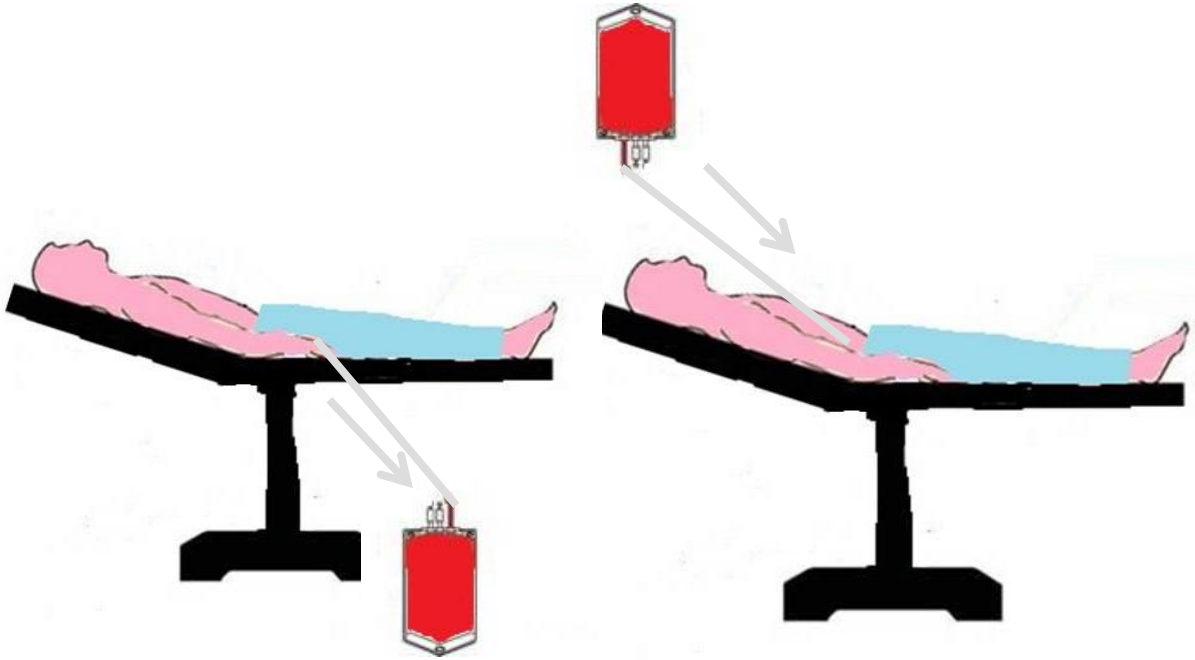


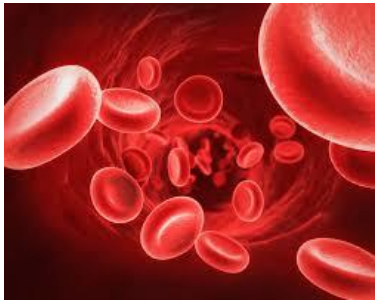
Cell salvage-return





Cell salvage- Post operative





Definitions

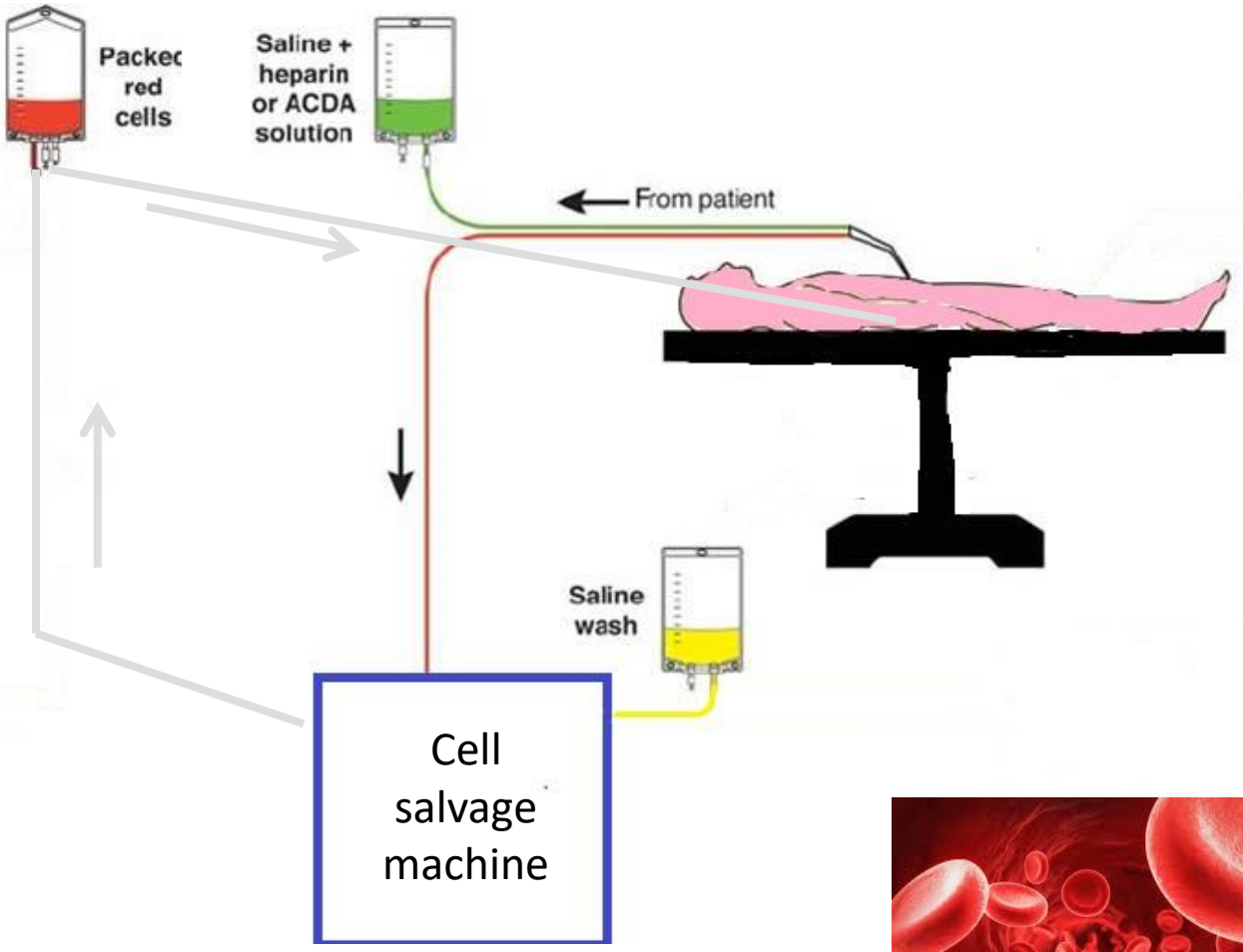
In continuity

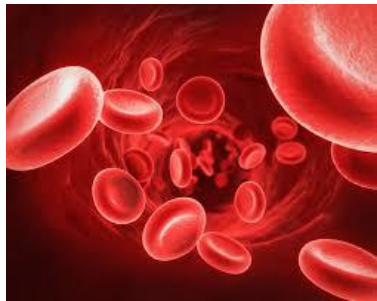
- Connection between

Continuous circuit

- a roughly circular line, route, or movement that starts and finishes at the same place

Cell salvage





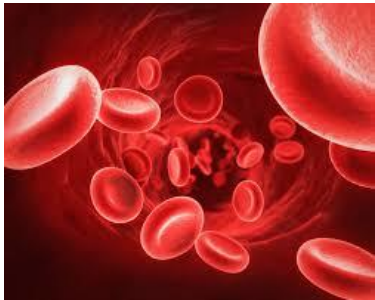
Clotting factors

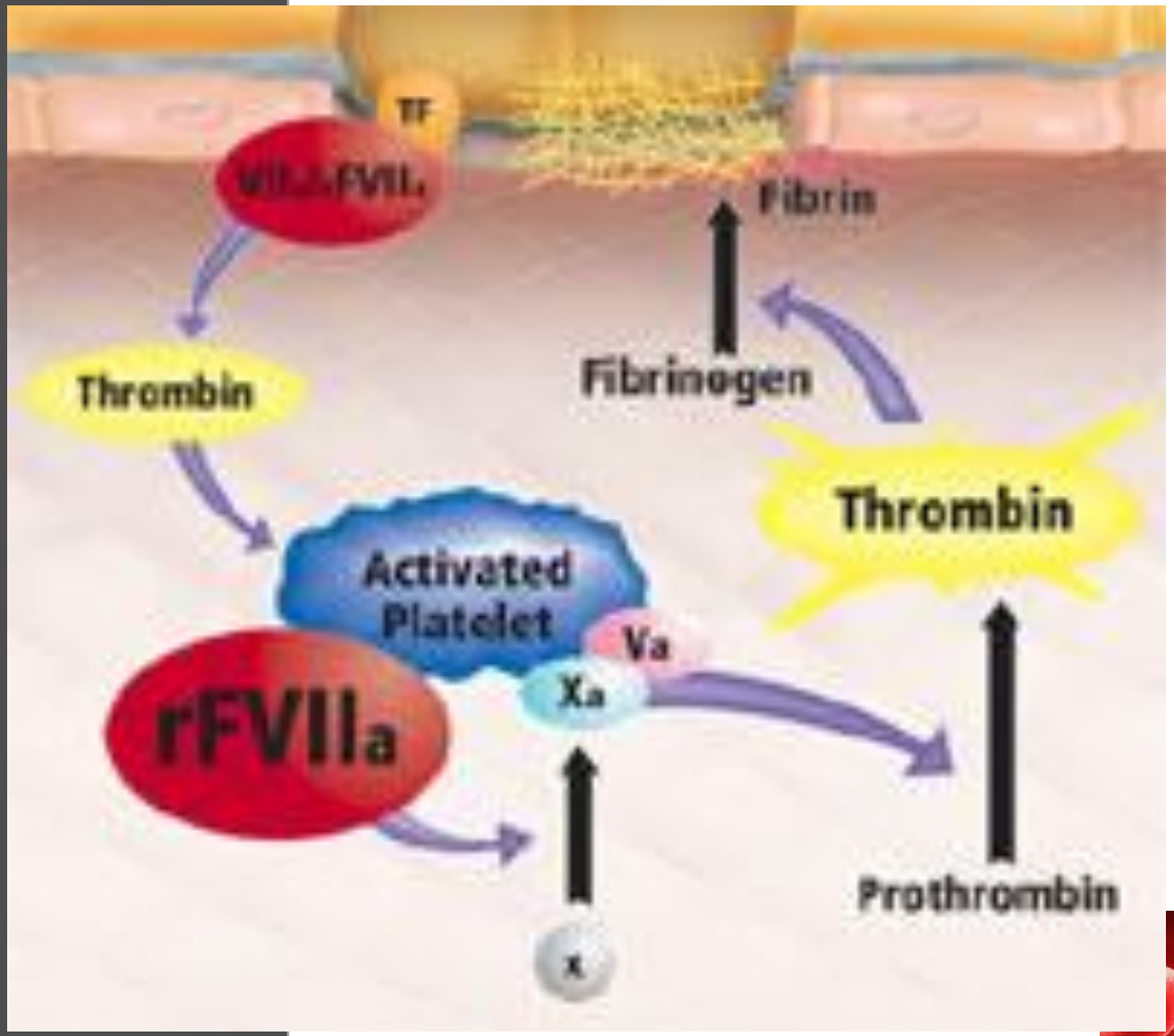
Plasma derived

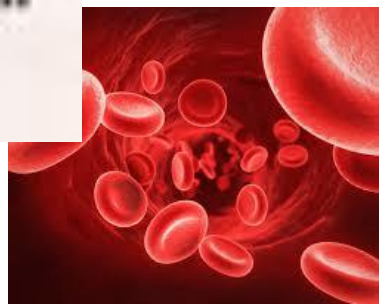
- Albumin
- IVIG
- FVIII
- FIX

Recombinant

- Human gene inserted into non human cell, factors produced
- FVIII
- FIX
- FVIIa




TF
VIIa-FVIIa
Fibrin
Thrombin
Fibrinogen
Thrombin
Activated Platelet
Va
Xa
rFVIIa
Prothrombin
X



Cancer nurse specialist said

‘It’s NOT the role of the Cancer MDT to check Hb’

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30 y o F for mastectomy for breast ca

‘…but it is the role of the Cancer MDT to check Hb’

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Surgeon said

‘We just needed to get on with op’

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35 y o F myomectomies to help with fertility

‘…but we need a good plan’

Case 2
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‘…we do too’

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Questions