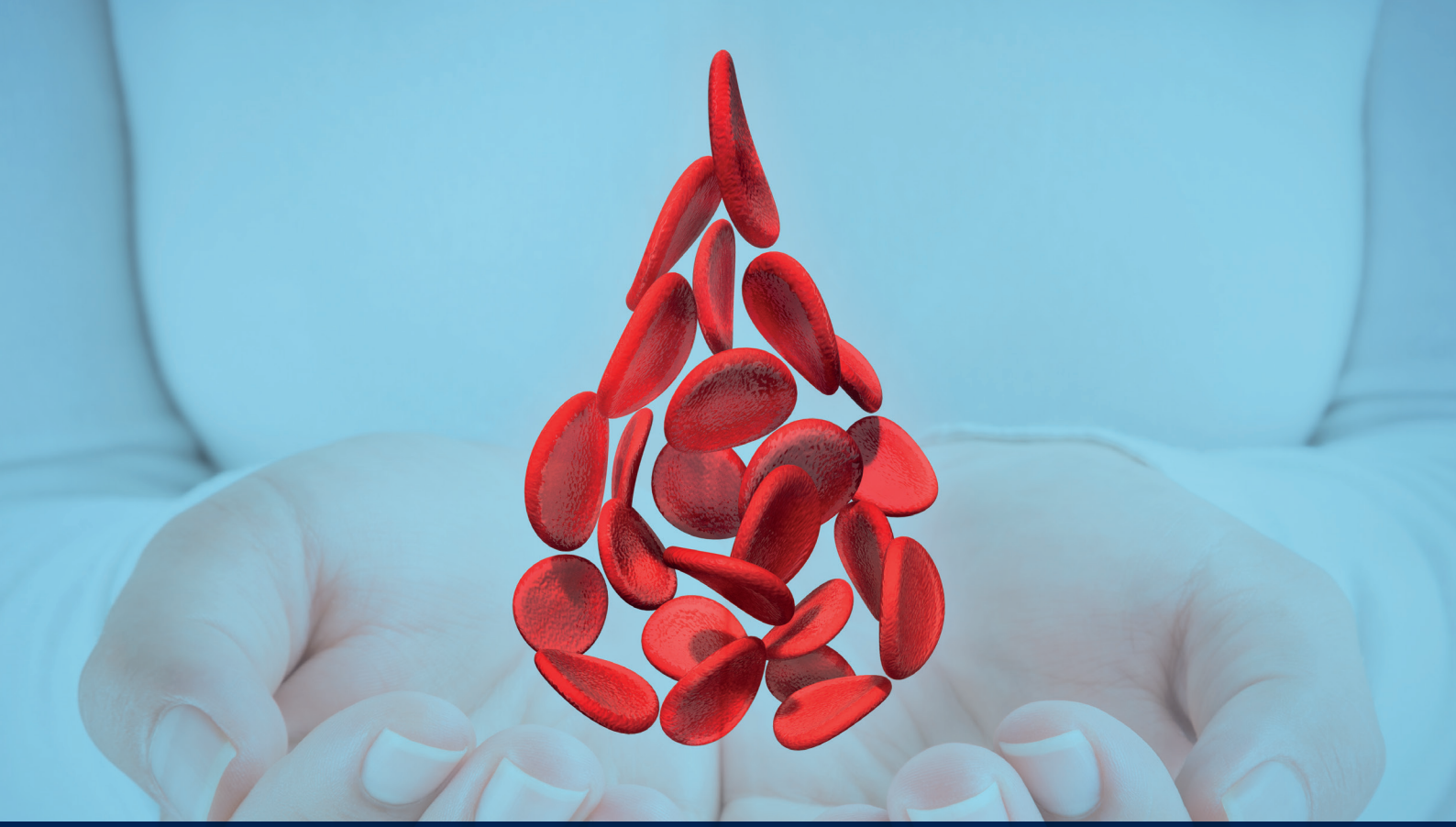

Cell Salvage as an Integral Part of Patient Blood Management

Bringing patient blood management into focus: helping to optimise patient outcomes, supporting best practice and efficiency

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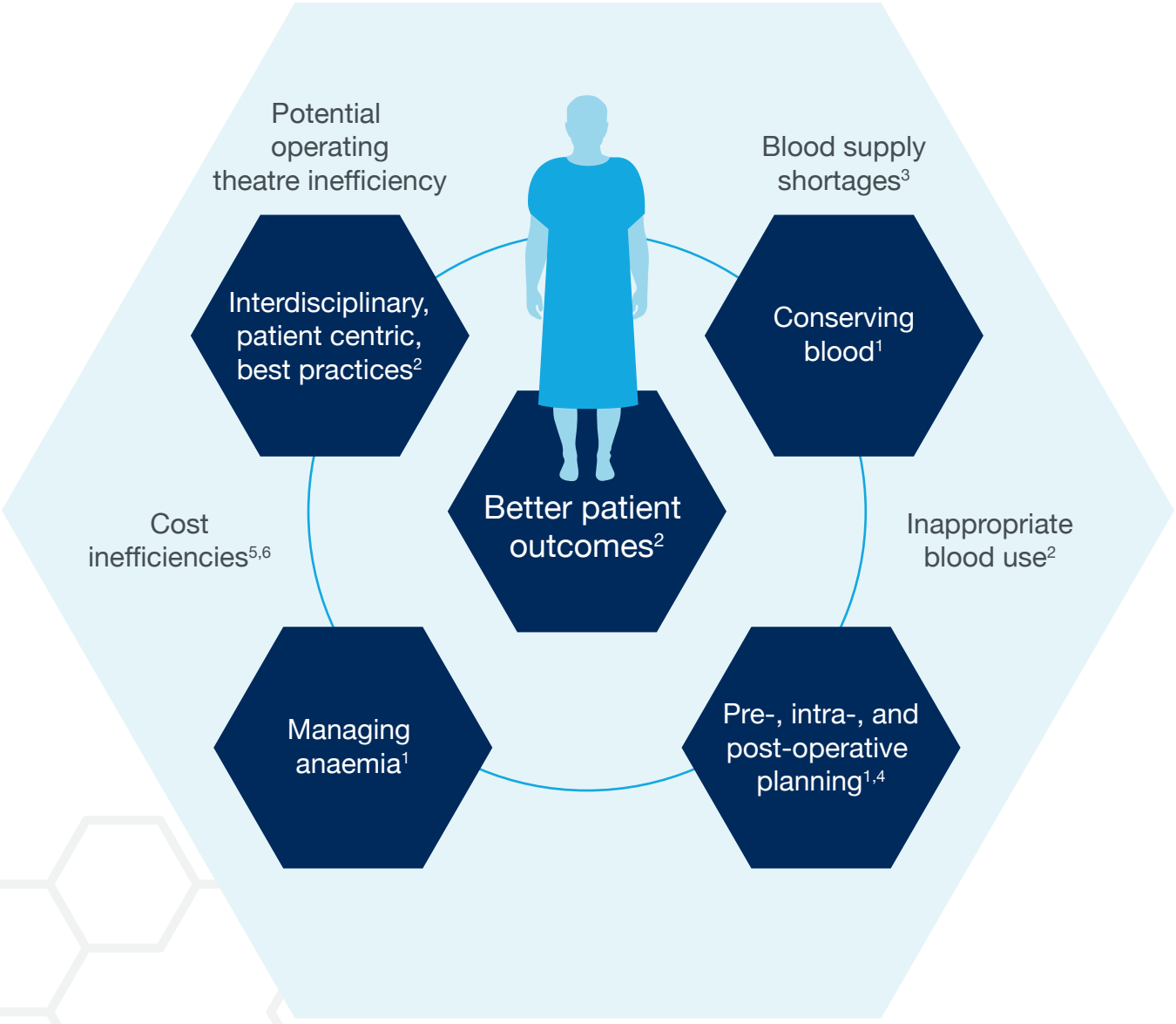
Cell salvage (autologous blood transfusion) is an integral part of patient blood management

"Patient blood management (PBM) is a multidisciplinary, evidence-based approach to optimising the care of patients who might need a blood transfusion:"[1]

- It encompasses measures to avoid transfusion such as anaemia management without transfusion, cell salvage and the use of anti-fibrinolytic drugs to reduce bleeding, as well as restrictive transfusion[1]
- "It puts the patient at the heart of decisions made about blood transfusion to ensure they receive the best treatment and avoidable, inappropriate use of blood and blood components is reduced"[2]
- It represents international best practice for transfusion medicine[2]
- It is a long-term process to improve patient care and save money[2]
- It requires co-ordinated planning at national and local level, with associated resources and investment[2]



There is a need to manage blood supply more efficiently, by increasing supply and reducing demand[4]

Risks associated with blood transfusion mean that use of blood components is restrictive.[7] Clinical guidelines emphasise the importance of these restrictions; however, numerous studies indicate that adherence to guidelines is often less than optimal.[7] National, regional and local audits in England have identified inappropriate use of all blood components to some degree,[2] and consistently show that 15–20% of red blood cell transfusion is not compliant with national guidelines.[1]

The COVID-19 pandemic has had major implications for blood transfusion, with uncertain patterns of demand and the need to plan for reductions in donations and loss of crucial staff as a result of sickness and public health restrictions.[3] Blood tube shortages have also affected allogeneic (donor) blood transfusion capability.[8]

Ongoing concerns over current and possible future blood shortages have resulted in increased efforts to manage the blood supply more efficiently, by increasing the supply and reducing the demand for blood.[4]

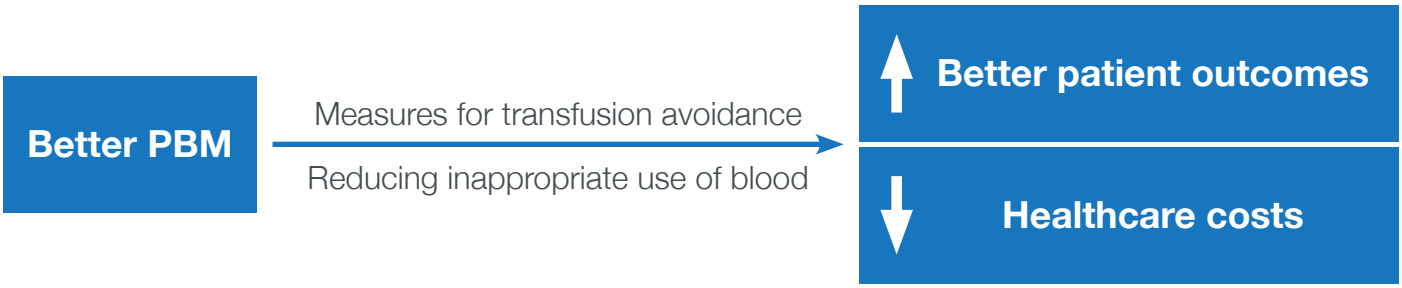
Allogeneic blood transfusion, whilst needed in certain cases, is impacted by reduced blood donations,[9] carries potential cost implications[10] and is not without risks compared to autologous blood transfusion.[11,12]

Allogeneic (donor) blood transfusion		
Risks	**Cost implications**	**Availability**
▪ Wrong blood incidents/ human error[13,14] ▪ Transmission of infection[13-15] ▪ Higher morbidity and mortality[15] ▪ Immunosuppression/ autoimmunisation:[16] more difficult match second time around[15]	▪ High costs[10] that are rising[17] ▪ Length of stay[18] ▪ Costs associated with transfusion reactions[6] ▪ Potential waste if surgery rescheduled	▪ Affected by blood shortages[9] ▪ Blood supply is limited and can expire[9]

Better PBM improves patient outcomes and helps to reduce healthcare costs[2]

Reducing the demand through blood conservation can help manage supplies more effectively; this takes many forms, and may occur in both medical and surgical settings.[4] The cost of allogeneic red blood cells has increased over time.[17] Transfusion reactions account for almost 35% of the cost of allogeneic red blood cell (RBC) transfusions,[6] and RBC transfusions have been shown to be independently associated with significantly higher hospital costs.[19]

Financial implications of transfusions support the implementation of PBM and efforts to reduce the rate of RBC transfusions.[19] By focussing on measures for the avoidance of transfusion and reducing the inappropriate use of blood, implementation of PBM improves patient outcomes and helps to reduce healthcare costs.[2]



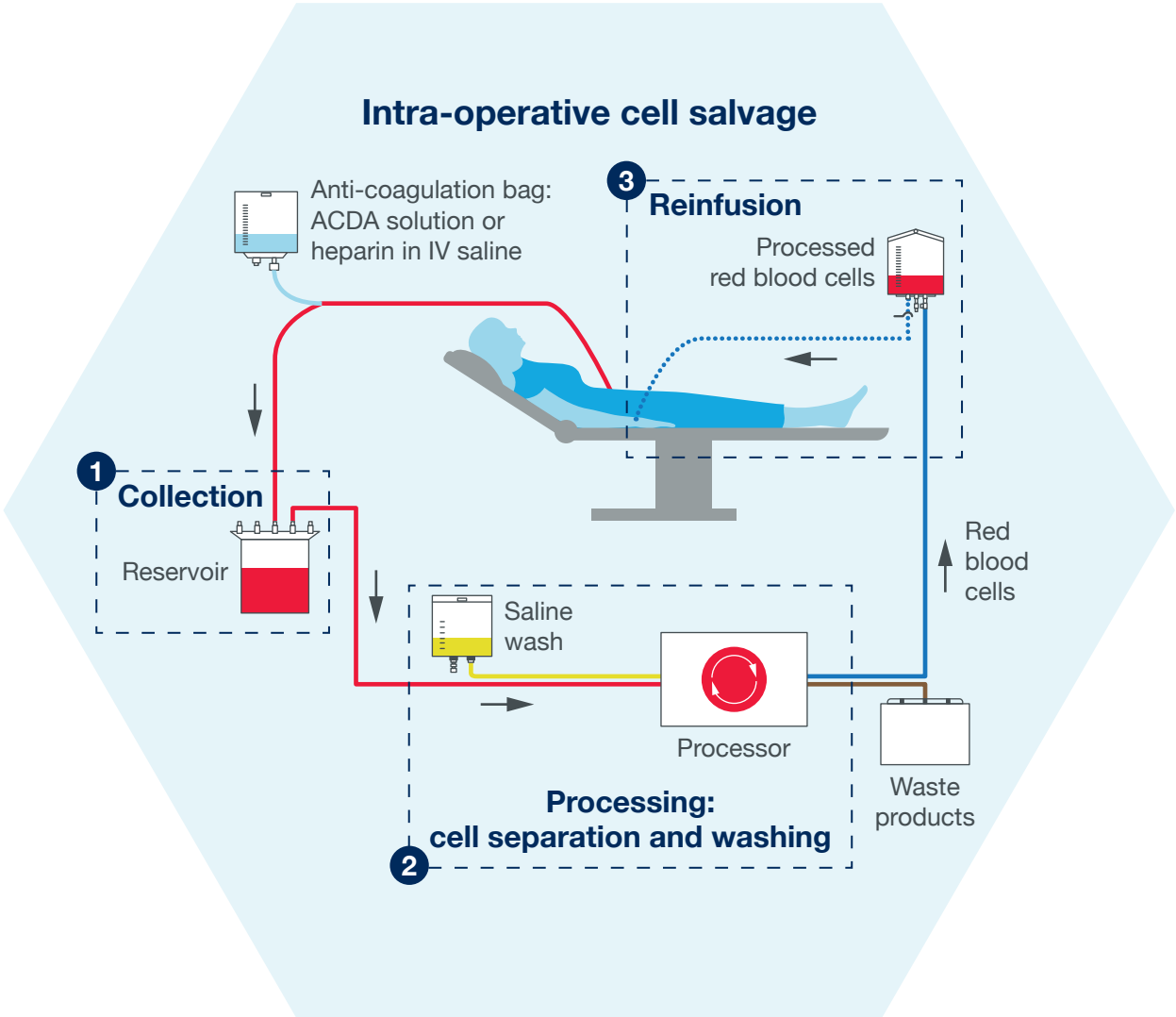
Blood conservation strategies for surgical patients, as listed in the table below, are a major component of PBM.[1,4]

Strategies for blood conservation[4]		
Pre-operative	**Intra-operative**	**Post-operative**
▪ Maximum surgical blood order schedule ▪ Assessment clinics ▪ Iron ▪ Erythropoietin	▪ **Cell salvage** ▪ Anaesthetic technique ▪ Normothermia ▪ Tranexamic acid ▪ Surgical technique ▪ Haemostats and sealants ▪ Point of care tests	▪ Minimise blood loss ▪ **Cell salvage** ▪ Transfusion thresholds ▪ Review requirement for transfusion ▪ Iron ▪ Erythropoietin

What is cell salvage?

Cell salvage, or autologous blood transfusion, can be used as an alternative to allogeneic blood transfusion[1]

- It is the process whereby blood shed during an operation is collected, filtered and washed to produce autologous red blood cells for transfusion to the patient:[5]



When is cell salvage recommended?

Cell salvage should be considered for surgical procedures where blood loss may exceed 500 ml (or > 10% of calculated total blood volume) in adult patients, or > 8 ml/kg (> 10% of calculated total blood volume) in children weighing > 10 kg.[20,21]

Intra-operative cell salvage should be used alongside tranexamic acid and is recommended only for patients who are expected to lose a very high volume of blood in procedures such as:[22]

- In cardiac and complex vascular surgery[22]
- In pelvic reconstruction and scoliosis surgery[22]
- In obstetric practice during caesarean section[5]
- After vaginal delivery in patients with conditions such as placenta previa or placenta accrete[5]
- During radical prostatectomy or radical cystectomy[23]

Cell salvage is beneficial for patients, and cost effective for the hospital

"The use of cell salvage is recommended when it can be expected to reduce the likelihood of allogeneic red cell transfusion and/or severe postoperative anaemia,"[20] with the additional potential benefits of:

- Reducing the incidence of transfusion reactions and transfusion-related infection, compared with allogeneic transfusion[5]
- Being useful when there are difficulties with cross-matching[5]
- Offering an option for patients who object to allogeneic blood transfusion on religious or other grounds[23]

Cell salvage has been demonstrated to be safe and effective in reducing allogeneic blood transfusions.[24] Advantages for patients include:

- Use of fresh, own blood[25]
  - Quicker recovery, better patient outcomes[18]
  - Oxygen transport is preserved as 2,3 DPG levels are high[18]
  - Reduces risk of immunomodulation and post-operative infection[26]
  - Avoids risk with allogeneic blood usage[25]
- Prevention of anaemia[27]
- Decreased patient morbidity and mortality[27]
- Acceptable to most Jehovah's witnesses[20]

Cell salvage may also help with scheduling and reduce delays in the operating theatre, due to:

- Potential reduction in the need to pre-order blood
- Option to collect only and process when needed
- Limited chance of processing error

Cell salvage can be cost effective, as a result of:[26]

- Reduced allogeneic blood usage[26]
- Potential for reduced waste of blood (especially rare) if surgery postponed
- Shorter post-operative hospital stay[18]

PBM, including cell salvage, plays an essential role in improving patient outcomes and reducing costs

Benefits of cell salvage		
Patient	**Healthcare professional**	**Hospital**
▪ Quicker recovery[18] ▪ Safer[27] ▪ Better outcomes[18]	▪ Availability[9] ▪ Ease of match[5] ▪ Collect only option	▪ Shorter length of stay[18] ▪ Cost efficiency[5,6] ▪ Fewer adverse effects[5]

Cell salvage reduces requirements for allogeneic transfusions, along with the associated risks and costs:[26]

- Provides high-quality transfusion, since the cells have not been subjected to the adverse effects of storage that occur with banked blood
- Avoids the risks for red blood cell alloimmunisation and transfusion-related infectious diseases
- Offers a more cost-effective solution for appropriate surgical cases

The COVID-19 pandemic has impacted medical care across the world, resulting in impediments to the blood supply.[9] With ongoing concerns over current and possible future blood shortages, experts have highlighted the essential role of cell salvage as an integral part of PBM in improving patient outcomes.[9]

Find out more about cell salvage by contacting your local Haemonetics representative

References:

1. NBTC Patient Blood Management: An evidence-based approach to patient care, 2014: 1-10.

2. NBTC 2018 Survey of Patient Blood Management, 2018: 1-26. Available at https://nhsbtdbe.blob.core.windows.net/umbraco-assets-corp/17064/2018-survey-of-pbm.pdf [Last accessed September 2022].

3. Stanworth S. *et al.* Effects of the COVID-19 pandemic on supply and use of blood for transfusion, *The Lancet*, 2020; 7: e756–64.

4. UKCSAG ICS Education Workbook 2018, 2018: 1-107. Available at: https://www.transfusionguidelines.org/transfusion-practice/uk-cell-salvage-action-group/intraoperative-cell-salvage-education [Last accessed September 2022].

5. NICE Intraoperative blood cell salvage in Obstetrics (ipg144), 2005: 1-6.

6. Glenngård *et al.* Costs associated with blood transfusions in Sweden – the societal cost of autologous, allogeneic and perioperative RBC transfusion, *Transfusion Medicine*, 2005; 15(4): 295-306.

7. Oddason K.E. *et al.* Inappropriate use of blood components in critical care? *Laeknabladid*, 2014;100(1): 9.

8. SHOT UK Transfusion guidance in response to the shortage of blood collection tubes, 2021: 1-4. Available at: https://www.rcpath.org/uploads/assets/2c7cd878-26a2-4bb7-8057f1e103aebd88/UK-Transfusion-guidance-for-sample-tube-shortages13-September-2021.pdf [Last accessed September 2022].

9. Shander A. *et al.* Essential Role of Patient Blood Management in a Pandemic: A Call for Action, *Anesth Analg*, 2020; 131(1): 74-85.

10. Madjdpour C. *et al.* Risks, benefits, alternatives and indications of allogenic blood transfusions, *Minerva Anestesilogiga*, 2006; 72(5): 283-98.

11. SHOT Figures from the annual SHOT Report 2020, 2020: 1-97.

12. SHOT SHOT Bite No. 21: Cell salvage - Insights from SHOT reports, 2021: 1-2.

13. Marcucci C. *et al.* Allogeneic blood transfusions: benefit, risks and clinical indications in countries with a low or high human development index, *British Medical Bulletin*, 2004; 70(1): 15-28.

14. Goodnough L.T. Risks of blood transfusion. *Crit Care Med*, 2003: S678–86.

15. Vamvakas E.C. *et al.* Blood still kills: six strategies to further reduce allogeneic blood transfusion- related mortality, *Transfusion Medicine Reviews*, 2010; 24(2): 77-124.

16. Young P.P. *et al.* Autoantibody formation after alloimmunization: are blood transfusions a risk factor for autoimmune hemolytic anemia? *Transfusion*, 2004; 44: 67–72.

17. Amin M. *et al.* The cost of allogeneic red blood cells – a systematic review, *Transfusion Medicine*, 2003; 13(5): 275.

18. Scott B.H. *et al.* American Society of Anesthesiologists, Abstract A1014, 2006.

19. Trentino K.M. *et al.* Increased hospital costs associated with red blood cell transfusion, *Transfusion*, 2014; 55(5): 1082-9.

20. Klein A.A. *et al.* Association of Anaesthetists guidelines: cell salvage for peri-operative blood conservation, *Anaesthesia*, 2018; 73: 1141–50.

21. European Society of Cardiology. 2022 ESC Guidelines on cardiovascular assessment and management of patients undergoing non-cardiac surgery. *European Heart Journal*, 2022; 00: 1–99.

22. NICE Blood transfusion (ng24), 2015: 1-30.

23. NICE Intraoperative red blood cell salvage during radical prostatectomy or radical cystectomy (ipg258), 2008: 1-7.

24. Xie J. *et al.* Is postoperative cell salvage necessary in total hip or knee replacement? A meta-analysis of randomized controlled trials, *International Journal of Surgery*, 2015; 21: 135-44.

25. Sikorski R.A. *et al.* Autologous blood salvage in the era of patient blood management, *Vox Sanguinis*, 2017; 112: 499–510.

26. Frank S.M. *et al.* Clinical Utility of Autologous Salvaged Blood: a Review, *J Gastrointest Surg*, 2020; 24(2): 464-472.

27. Baron D.M. *et al.* Patient blood management during the COVID–19 pandemic: a narrative review, *Anaesthesia*, 2020; 75: 1105–13.

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