



**University of
Zurich**^{UZH}

**Zurich Open Repository and
Archive**

University of Zurich
University Library
Strickhofstrasse 39
CH-8057 Zurich
www.zora.uzh.ch

Year: 2019

Patient Blood Management : What Else?

Spahn, Donat R

DOI: <https://doi.org/10.1097/sla.0000000000003186>

Posted at the Zurich Open Repository and Archive, University of Zurich

ZORA URL: <https://doi.org/10.5167/uzh-180775>

Journal Article

Published Version

Originally published at:

Spahn, Donat R (2019). Patient Blood Management : What Else? *Annals of Surgery*, 269(5):805-807.

DOI: <https://doi.org/10.1097/sla.0000000000003186>

Patient Blood Management

What Else?

Donat R. Spahn, MD, FRCA

Patient Blood Management is an evidence-based concept aiming at preemptively reducing the need for red blood cell (RBC) transfusions to improve patient safety and outcome. Patient Blood Management is based on 3 pillars: preoperative treatment of anemia and iron deficiency, reduction of perioperative blood loss, and optimization of anemia tolerance including the utilization of restrictive transfusion triggers. Safety and efficacy of patient blood management has been shown in a variety of studies including 2 studies with more than 100,000 patients each.^{1,2}

Althoff et al³ in this issue of the journal present an impressive meta-analysis on studies that assessed the impact of the implementation of at least 1 patient blood management measure in each of the 3 pillars on outcome. The results are staggering (Table 1).

Given this impressive safety and efficacy, the question arises why patient blood management has not yet been introduced in all hospitals worldwide as a standard. A number of physicians may be overwhelmed by the large number (>100) of patient blood management measures that have been described.⁴ In an initial phase of the introduction of patient blood management, I advise focusing on the following 7 measures:

1. Preoperative anemia treatment
2. Blood sparing surgical techniques with meticulous hemostasis
3. Use of cell salvage
4. Use of tranexamic acid
5. Advanced individualized and goal-directed coagulation management including monitoring and use of coagulation factor concentrates
6. Postoperative anemia treatment with i.v. iron
7. Restrictive transfusion triggers.

Even the introduction of these 7 key measures may seem difficult to a number of physicians. Therefore, the European Union and the National Blood Authority of Australia have issued implementation guides.^{5,6} These guides provide some help. They, however, need to be adapted to the local situation in each hospital. In some hospitals a patient blood management program may be initiated by the board of directors with specific resources allocated. In most hospitals, patient blood management programs, however, started small and developed consecutively over years. In the latter context, the leader of the patient blood management program needs to be defined first; in many hospitals, this is a particularly enthusiastic anesthesiologist. The

From the Institute of Anesthesiology, University and University Hospital of Zurich, Zurich, Switzerland.

Invited editorial accompanying ANNSURG-D-18-01668R1.

Dr Spahn's academic department is receiving grant support from the Swiss National Science Foundation, Berne, Switzerland, the Swiss Society of Anesthesiology and Reanimation (SGAR), Berne, Switzerland, the Swiss Foundation for Anesthesia Research, Zurich, Switzerland, CSL Behring, Berne, Switzerland, Vifor SA, Villars-sur-Glâne, Switzerland. He is co-chair of the ABC-Trauma Faculty, sponsored by unrestricted educational grants from Novo Nordisk Health Care AG, Zurich, Switzerland, CSL Behring GmbH, Marburg, Germany, LFB Biomédicaments, Courtaboeuf Cedex, France and Octapharma AG, Lachen, Switzerland. He has received honoraria or travel support for consulting or lecturing from: Danube University of Krems, Austria, US Department of Defense, WA, European Society of Anesthesiology, Brussels, BE, Korean Society for Patient Blood Management, Seoul, Korea, Korean Society of Anesthesiologists, Seoul, Korea, Baxter AG, Volketswil, Switzerland, Baxter S.p.A., Roma, Italy, Bayer AG, Zürich, Switzerland, Bayer Pharma AG, Berlin, Germany, B. Braun Melsungen AG, Melsungen, Germany, Boehringer Ingelheim GmbH, Basel, Switzerland, Bristol-Myers-Squibb, Rueil-Malmaison Cedex, France and Baar, Switzerland, CSL Behring GmbH, Hattersheim am Main, Germany and Berne, Switzerland, Celgene International II Sàrl, Couvet, Switzerland, Curacyte AG, Munich, Germany, Daiichi Sankyo AG, Thalwil, Switzerland, GlaxoSmithKline GmbH & Co. KG, Hamburg, Germany, Haemonetics, Braintree, MA, Instrumentation Laboratory (Werfen), Bedford, MA, LFB Biomédicaments, Courtaboeuf Cedex, France, Merck Sharp & Dohme, Kenilworth, NJ, Octapharma AG, Lachen, Switzerland, Organon AG, Pfäffikon/SZ, Switzerland, PAION Deutschland GmbH, Aachen, Germany, Pharmacosmos A/S, Holbaek, Denmark, Photonics Healthcare B.V., Utrecht, The Netherlands, Roche Diagnostics International Ltd, Reinach, Switzerland, Roche Pharma AG, Reinach, Switzerland, Sarstedt AG & Co., Sevelen, Switzerland and Nümbrecht, Germany, Schering-Plough International, Inc., Kenilworth, NJ, Tem International GmbH, Munich, Germany, Verum Diagnostica GmbH, Munich, Germany, Vifor Pharma, Munich, Germany, Vienna, Austria and Villars-sur-Glâne, Switzerland, Vifor (International) AG, St. Gallen, Switzerland.

The authors report no conflicts of interest

Reprints: Donat R. Spahn, MD, FRCA, Professor and Chairman, Institute of Anesthesiology Head Anesthesiology, Intensive Care Medicine, OR-Management University of Zurich and University Hospital Zurich, Raemistrasse 100 CH-8091, Zurich, Switzerland. E-mail: donat.spahn@usz.ch.

Copyright © 2018 Wolters Kluwer Health, Inc. All rights reserved.

ISSN: 0003-4932/18/26905-0805

DOI: 10.1097/SLA.0000000000003186

TABLE 1. Benefits of Patient Blood Management

	Change	P	Number of Patients
Transfusion rate	−39%	<0.00001	207,006
RBC unit per patient	−0.43 unit	<0.00001	216,657
Hospital LOS	−0.45 day	<0.00001	219,850
Major complications	−20%	<0.00001	214,298
Acute renal failure	−26%	<0.00001	166,955
Infection rate	−9%	<0.03	192,987
Thromboembolic events	−25%	<0.00001	170,189
Mortality	−11%	<0.02	221,528

LOS indicates length of stay.

second step is to choose the best-suited surgical discipline, which at many places is orthopedic surgery due long scheduling times allowing easy preoperative anemia treatment.^{7,8} Then it is crucial to act data based. This means that data need to be collected systematically regarding preoperative anemia, perioperative blood loss, and transfusions and postoperative complications, length of hospital stay, and costs. This data collection needs to start long before the start of a patient blood management program to have a reliable baseline and continue thereafter. These data from within an individual hospital will convince implicated physicians and result in better program adherence. These data will convince other surgical disciplines and result in expansion of the program to these other surgical disciplines. Finally, these data will convince the Board of Directors and result in resource allocation for the patient blood management program.

Despite many aspects being clarified today, there are issues that need future research or particular attention. One is the question of whether preoperative iron deficiency without concomitant anemia requires treatment. Preoperative iron deficiency in cardiac surgery resulted in increased RBC transfusions and fatigue⁹ and a trend toward a longer hospital length of stay.¹⁰ There is, however, hardly any data in noncardiac surgery and this certainly requires future research.

The use of tranexamic acid has been shown to be safe and to reduce RBC transfusions in most all surgical disciplines.¹¹ The prophylactic use of tranexamic acid thus can be recommended in most patients undergoing major surgery.

Advanced individualized and goal-directed coagulation management including monitoring and use of coagulation factor concentrates has been shown to reduce significantly transfusions and mortality in a variety of surgical settings from trauma treatment¹² to cardiac surgery.¹³

The preoperative administration of i.v. iron to treat iron deficiency anemia is well known and increasingly used. The postoperative use of i.v. iron, however, is much less common despite the fact that there are several prospective randomized studies documenting safety and efficacy.^{14,15} Clearly, this area deserves greater clinical attention.

The future potential of patient blood management is extremely high. Patients, treated at centers that have not yet implemented patient blood management will benefit in all domains listed in Table 1. In centers that have only implemented some measures, patients will benefit more with the introduction of additional measures. Patients, treated at centers that have introduced multiple measures already may benefit from a more consistent application of these measures. Finally yet importantly, patient blood management has traditionally been implemented in surgery. Patient blood management principles can, however, also be used in most of the internal medicine specialties including oncology.¹⁶

As with each program, costs are an issue. Many are concerned about additional costs of a patient blood management program. All

big programs, however, consistently report major cost savings, in Germany,¹ in Australia,² in the United States,¹⁷ and in Switzerland.¹⁸ These reported cost savings are blood product acquisition cost. They, however, represent just about a third of the true, that is, activity-based costs, which are relevant for hospitals.¹⁹ The focus on blood product acquisition cost thus significantly underestimates the cost savings. In addition, the savings due to avoided complications and mortality need to be considered as well. It may be difficult to calculate the exact treatment cost of each complication. Nevertheless, from a patient and economics point of view it is certainly worthwhile avoiding any complication and mortality.²⁰

Now that safety and efficacy of patient blood management has systematically been confirmed by this meta-analysis, the stage is set for worldwide implementation. Conversely, not implementing patient blood management represents substandard care.

REFERENCES

- Meybohm P, Herrmann E, Steinbicker AU, et al. Patient blood management is associated with a substantial reduction of red blood cell utilization and safe for patient's outcome: a prospective, multicenter cohort study with a noninferiority design. *Ann Surg.* 2016;264:203–211.
- Leahy MF, Hofmann A, Towler S, et al. Improved outcomes and reduced costs associated with a health-system-wide patient blood management program: a retrospective observational study in four major adult tertiary-care hospitals. *Transfusion.* 2017;57:1347–1358.
- Althoff FC, Neb H, Herrmann E, et al. Multimodal patient blood management program based on a three-pillar strategy: a systematic review and meta-analysis. *Ann Surg.* 2019;269:794–804.
- Meybohm P, Richards T, Isbister J, et al. Patient blood management bundles to facilitate implementation. *Transfus Med Rev.* 2017;31:62–71.
- Supporting Patient Blood Management (PBM) in the EU- A Practical Implementation Guide for Hospitals. Available at: https://ec.europa.eu/health/sites/health/files/blood_tissues_organs/docs/2017_eupbm_hospitals_en.pdf, Accessed November 29, 2018.
- National Patient Blood Management Implementation Strategy 2017–2021. Available at: <https://www.blood.gov.au/implementing-pbm>. Accessed November 29, 2018.
- Gupta PB, DeMario VM, Amin RM, et al. Patient blood management program improves blood use and clinical outcomes in orthopedic surgery. *Anesthesiology.* 2018;129:1082–1091.
- Theusinger OM, Kind SL, Seifert B, et al. Patient blood management in orthopaedic surgery: a four-year follow-up of transfusion requirements and blood loss from 2008 to 2011 at the Balgrist University Hospital in Zurich, Switzerland. *Blood Transfus.* 2014;12:195–203.
- Piednoir P, Allou N, Driss F, et al. Preoperative iron deficiency increases transfusion requirements and fatigue in cardiac surgery patients: a prospective observational study. *Eur J Anaesthesiol.* 2011;28:796–801.
- Miles LF, Kunz SA, Na LH, et al. Postoperative outcomes following cardiac surgery in non-anaemic iron-replete and iron-deficient patients—an exploratory study. *Anaesthesia.* 2018;73:450–458.
- Ker K, Edwards P, Perel P, et al. Effect of tranexamic acid on surgical bleeding: systematic review and cumulative meta-analysis. *BMJ.* 2012;344:e3054.
- Stein P, Kaserer A, Sprengel K, et al. Change of transfusion and treatment paradigm in major trauma patients. *Anaesthesia.* 2017;72:1317–1326.
- Weber CF, Gorlinger K, Meininger D, et al. Point-of-care testing: a prospective, randomized clinical trial of efficacy in coagulopathic cardiac surgery patients. *Anesthesiology.* 2012;117:531–547.
- Khalafallah AA, Yan C, Al-Badri R, et al. Intravenous ferric carboxymaltose versus standard care in the management of postoperative anaemia: a prospective, open-label, randomised controlled trial. *Lancet Haematol.* 2016;3:e415–e425.
- Kim YW, Bae JM, Park YK, et al. Effect of intravenous ferric carboxymaltose on hemoglobin response among patients with acute isovolemic anemia following gastrectomy: the FAIRY randomized clinical trial. *JAMA.* 2017;317:2097–2104.
- Leahy MF, Trentino KM, May C, et al. Blood use in patients receiving intensive chemotherapy for acute leukemia or hematopoietic stem cell transplantation: the impact of a health system-wide patient blood management program. *Transfusion.* 2017;57:2189–2196.
- Madrigal E, Prajapati S, Avadhani V, et al. Adequacy of physician documentation and correlation with assessment of transfusion appropriateness: a

- follow-up study in the setting of prospective audits and patient blood management. *Transfusion*. 2017;57:367–375.
18. Mehra T, Seifert B, Bravo-Reiter S, et al. Implementation of a patient blood management monitoring and feedback program significantly reduces transfusions and costs. *Transfusion*. 2015;55:2807–2815.
 19. Shander A, Hofmann A, Ozawa S, et al. Activity-based costs of blood transfusions in surgical patients at four hospitals. *Transfusion*. 2010;50:753–765.
 20. Kleineruschkamp A, Meybohm P, Straub N, et al. A model-based cost-effectiveness analysis of patient blood management. *Blood Transfus*. 2018;16:1–17.