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Patient Blood Management in Anesthesia: An Analysis of Anesthesiology Journals

Anestezide Hasta Kan Yönetimi: Anesteziyoloji Dergilerinin İncelenmesi

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ABSTRACT

Objective: Implementation of patient blood management has been demonstrated to improve patient outcomes and reduce the need for allogeneic blood transfusions in elective procedures. Herein, we aimed to analyze the publication trends on patient blood management between 2010 and 2022 to evaluate the level of significance and the relevance of anesthesiology journals associated to the topic of patient blood management.

Methods: The search strategy included the keywords "patient blood management, anemia, coagulopathy, coagulation, viscoelastic tests, antifibrinolytic, transfusion and cell salvage" between 2010 and 2022. The trend analysis included the rate of publications in anesthesiology journals, origin country of publications and the contributors.

Results: Between 2010 and 2022, 102327 articles were published on patient blood management. Among these articles 2693 (2.63%) were published in anesthesiology journals. Ninety-seven thousand eight hundred twenty-seven articles published in the 54 anesthesiology journals were included in this study. The rate of patient blood management publications was 2.75% in these journals.

Conclusion: Anesthesiologists have demonstrated a commendable level of interest in patient blood management, as evidenced by the fact that 2.63% of studies related to patient blood management were published in journals dedicated to anesthesiology. Two point seventy five percent of recent studies published in anesthesiology journals are directly associated with patient blood management, which underscores the importance and relevance of this subject in the field of anesthesiology. The significance of anesthesiologists' role on this subject is truly remarkable, based on the trend of patient blood management publications in anesthesiology journals in the recent decade.

Keywords: Patient blood management, perioperative care, perioperative period, blood transfusion, journal article

ÖZ

Amaç: Hasta kan yönetiminin uygulanmasının hasta sonuçlarını iyileştirdiği ve elektif prosedürlerde allojenik kan transfüzyonu ihtiyacını azalttığı gösterilmiştir. Bu çalışmada, hasta kan yönetimi konusuyla ilgili anesteziyoloji dergilerinin gösterdikleri önem ve alaka düzeyini değerlendirmek için 2010 ve 2022 yılları arasında hasta kan yönetimine ilişkin yayın eğilimlerini analiz etmeyi amaçladık.

Yöntem: Arama stratejisi olarak 2010-2022 yılları arasındaki "hasta kan yönetimi, anemi, koagülopati, koagülasyon, viskoelastik testler, antifibrinolitik, transfüzyon ve hücre kurtarma" anahtar kelimeleri dahil edildi. Trend analizi, anesteziyoloji dergilerindeki yayınların oranını, yayınların menşe ülkesini ve katkıda bulunanları içeriyordu.

Bulgular: Tüm literatürde 2010-2022 yılları arasında hasta kan yönetimi ile ilgili 102327 makale yayımlanmıştır. Bu makalelerin 2693'ü (%2,63) anesteziyoloji dergilerinde yayımlanmıştır. Bu çalışmaya dahil edilen 54 anesteziyoloji dergisinde ise toplamda 97827 makale yayımlanmıştır. Yayınlanmış bu yayınlar içerisinde hasta kan yönetimini konu alan yayınların oranı ise %2,75 olarak saptanmıştır.

Sonuç: Anestezistler, hasta kan yönetimine övgüye değer düzeyde bir ilgi göstermektediler. Bu, hasta kan yönetimiyle ilgili çalışmaların %2,63'ünün anesteziyoloji dergilerinde yayınlanmış olmasıyla kanıtlanmıştır. Anesteziyoloji dergilerinde yayınlanan tüm çalışmaların ise %2,75'i doğrudan hasta kan yönetimi ile ilişkilidir. Bu da konunun anesteziyoloji alanındaki önemini ve anestezistlerin hasta kan yönetimine alaka düzeyini vurgulamaktadır. Anestezistlerin bu konudaki rolünün önemi, son on yılda anesteziyoloji dergilerinde hasta kan yönetimi yayınlarına olan eğilim göz önüne alındığında dikkat çekicidir.

Anahtar sözcükler: Hasta kan yönetimi, perioperatif bakım, perioperatif dönem, kan nakli, dergi makalesi

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INTRODUCTION

According to the Society for the Advancement of Blood Management, patient blood management (PBM) is the application of evidence-based medical and surgical concepts include three pillars to maintain optimal hemoglobin concentration, improve hemostasis, reduce blood loss, and increase physiological tolerance to anemia in order to improve patient outcomes (1). The goal is to make proper use of blood to improve the overall standard of patient care and to ensure that the appropriate product is administered at the appropriate time to the appropriate patient for the appropriate purpose. Other benefits include lowering expenses and redistributing resources to where they are most needed (2).

The National Health Service Blood and Transfusion and the National Blood Transfusion Committee of the United Kingdom have started to support PBM after approval of the World Health Organization (WHO) (1). Then, there has been a paradigm shift from the product towards an emphasis on the patient which is named as patient centered PBM in transfusion medicine.

Patient blood management disregards conventional wisdom regarding treating anemia, which accepts the transfusion of red blood cells (RBC) as the primary therapy. It views the patient's blood as a resource that must be carefully conserved and managed as a standard of care, and it does so with the understanding that this blood belongs to the patient. In the context of a patient-centered, tailored management plan, the ratio of benefit to risk is assessed through the use of a variety of different approaches in order to arrive at the best choice (1).

In order to give the highest possible level of care to patients, anesthesiologists need to be familiar with the various developments occurring in medicine. Therefore, the goal of this study was to provide information about the importance of this topic among the anesthesiologists by looking at the PBM-related articles published between 2010 and 2022 in anesthesiology journals.

METHODS

The number of papers in the anesthesiology journals was analyzed in this study. This study did not include any human or animal participants. Subjects are articles. Therefore, obtaining neither ethical committee approval for the study nor consent form the patients were required.

The Pubmed, Scopus, and Web of Science databases were accessed online. The search strategy between 2010 and 2022 was to submit "patient blood management, anemia, coagulopathy, coagulation, viscoelastic assays, antifibrinolytic, transfusion, and cell salvage" as the keywords. The beginning date of 2010 was chosen because WHO mandates that member states implement a PBM system by this date. The analysis was restricted to published articles. Original articles, editorials, review articles, and case presentations were included. Letters and comments were not included. Duplicate publications were also excluded.

To evaluate the relevance of anesthesiology journals to studies on PBM, we extracted the anesthesiology journal articles from all PBM articles. As data sources, fifty-four anesthesiology journals were analyzed. Between 2010 and 2022, the number of PBM-related articles in these journals was compared to the total number of PBM-related publications per year. The publications were analyzed according to the publication year, the journal, and the author's country. Their affiliation and correspondence addresses determined the countries to which the authors belonged.

All data were input into a Microsoft Excel™ spreadsheet (Microsoft Corp.). The data were analyzed using the statistical program SPSS 22.0® (IBM Corp.). Data were expressed as number or percent.

RESULTS

Between years of 2010 and 2022, 102327 scholarly articles were published related to PBM. The number of publications increased annually and peaked in 2022 reaching out 9892. Number of PBM publications in anesthesiology journals varied between 127 to 238 within the 13 year-period analysis. However, the peak rate was observed in 2018 which was presented in Table I.

Table I. Rate of Patient Blood Management Publications Between Years 2010 and 2022

	Total number of PBM publications	Number of PBM publications in anesthesiology journals	%
2010	6088	127	2.08
2011	6477	164	2.53
2012	6841	216	3.15
2013	7447	189	2.53
2014	7418	220	2.96
2015	7580	216	2.84
2016	7796	204	2.61
2017	7866	228	2.89
2018	8068	238	2.94
2019	8197	236	2.87
2020	9158	229	2.50
2021	9499	218	2.29
2022	9892	208	2.10
Total	**102327**	**2693**	**2.63**

PBM: Patient blood management.

The 2693 (2.63%) out of 102327 articles were published in anesthesiology and annual publication rate per journal was displayed (Table II). The majority of these articles appeared in Journal of Cardiothoracic and Vascular Anesthesia (10.88%), Anesthesia and Analgesia (9.06%), Blood Transfusion (7.20%), British Journal of Anaesthesia (6.98%), and Anesthesiology (5.56%). Out of all the publications, 39.68% were found in the five mentioned journals, while the remaining 60.32% distributed among other journals.

When considering anesthesia journals, it was found that 13.43% of the publications were in the field of cardiothoracic anesthesia, 5.48% in intensive care anesthesia, 3.49% in pediatric anesthesia, 2.71% in obstetric anesthesia, and 0.92% in neurosurgical anesthesia.

Authors from 44 nations have contributed for publications. The top 5 countries included the United States of America, the United Kingdom, Canada, Switzerland, and Germany. Authors from a single country contributed to 1975 publications, while authors from different countries contributed to 718. The complete list of countries was provided in Table III.

Table II: Total Number of Patient Blood Management Publications by Year in Anesthesiology Journals

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total	%
AANA Journal	4	-	2	3	2	1	4	-	-	1	-	2	1	**20**	**0.74**
Acta Anaesthesiologica Belgica	5	1	-	1	-	1	-	-	-	-	-	-	-	**8**	**0.29**
Acta Anaesthesiologica Scandinavica	2	2	3	2	4	3	2	6	5	4	5	6	5	**49**	**1.81**
Acta Anaesthesiologica Taiwanica	-	1	2	-	2	2	-	-	-	-	-	-	-	**7**	**0.25**
Advances in Anesthesia	-	-	-	-	-	-	-	3	1	2	3	2	1	**12**	**0.44**
Anaesthesia	7	3	6	4	6	9	11	13	8	15	21	15	9	**127**	**4.71**
Anaesthesia and Intensive Care	5	6	3	9	5	5	4	6	4	3	1	3	5	**59**	**2.19**
Anaesthesia, Critical Care & Pain Medicine	-	-	-	-	-	4	-	3	4	3	4	3	2	**23**	**0.85**
Anaesthesiology Intensive Therapy	-	-	1	-	2	-	-	1	2	1	1	4	-	**12**	**0.44**
Anästhesiologie, Intensivmedizin, Notfallmedizin, Schmerztherapie	2	5	5	3	6	1	2	4	1	5	1	1	2	**38**	**1.41**
Anesthesia and Analgesia	12	9	10	9	16	8	23	31	35	23	21	18	29	**244**	**9.06**
Anesthesia Progress	-	-	-	-	-	-	-	1	1	2	-	-	-	**4**	**0.14**
Anesthesia, Essays and Researches	-	1	1	2	3	2	1	1	1	2	3	3	2	**22**	**0.81**
Anesthesiology	12	15	22	7	11	16	10	17	11	4	10	8	7	**150**	**5.56**
Anesthesiology and Pain Medicine	-	-	1	-	1	1	-	1	-	1	-	-	1	**6**	**0.22**
Anesthesiology Clinics	2	1	4	2	3	1	2	1	3	2	1	3	2	**27**	**1.00**
Anesthesiology Research and Practice	-	-	1	-	1	1	-	2	1	1	-	1	1	**9**	**0.33**
Annales Françaises d'anesthesie et de Reanimation	3	5	11	6	3	-	-	-	-	-	-	-	-	**28**	**1.03**
Annals of Cardiac Anaesthesia	-	-	1	3	2	4	6	2	7	3	2	4	5	**39**	**1.44**
Asian Journal of Anesthesiology	-	-	-	-	-	-	-	-	-	-	-	-	-	**0**	**0**
Blood Transfusion	9	18	19	17	11	10	9	14	27	19	16	11	14	**194**	**7.20**

Table II: Cont.

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total	%
BMC Anesthesiology	-	-	-	2	4	4	3	2	6	15	5	6	3	**50**	**1.85**
British Journal of Anaesthesia	6	13	16	12	18	11	20	19	14	10	16	15	18	**188**	**6.98**
Bulletin of Anesthesia History	-	-	-	-	-	-	-	-	-	-	-	-	-	**0**	**0**
Canadian Journal of Anaesthesia	3	2	9	7	6	5	4	2	3	7	9	9	5	**71**	**2.63**
Critical Care and Resuscitation	-	1	-	2	4	3	-	1	1	-	2	1	1	**16**	**0.59**
Current Opinion in Anaesthesiology	4	1	7	5	6	5	7	6	9	7	8	10	9	**84**	**3.11**
Der Anaesthesist	6	4	3	4	7	4	5	2	3	6	7	3	6	**60**	**2.22**
Die Anaesthesiologie	-	-	-	-	-	-	-	-	-	-	-	-	3	**3**	**0.11**
Egyptian Journal of Anaesthesia	-	-	3	2	1	1	2	1	-	1	1	-	1	**13**	**0.48**
European Journal of Anaesthesiology	4	6	3	4	7	3	5	3	5	6	8	9	6	**69**	**2.56**
Indian Journal of Anaesthesia	3	4	3	2	23	6	3	3	2	4	2	2	4	**61**	**2.26**
International Anesthesiology Clinics	-	1	1	2	1	-	1	1	2	1	-	2	1	**13**	**0.48**
International Journal of Obstetric Anesthesia	4	7	5	9	5	7	3	4	4	8	6	6	5	**73**	**2.71**
Journal of Anaesthesiology Clinical Pharmacology	-	1	-	1	1	-	-	1	-	1	-	-	1	**6**	**0.22**
Journal of Anesthesia	2	1	2	3	2	2	4	4	3	2	4	5	5	**39**	**1.44**
Journal of Anesthesia History	-	-	-	-	-	-	-	-	-	-	1	-	-	**1**	**0.03**
Journal of Anesthesia, Analgesia and Critical Care	-	-	-	-	-	-	-	-	-	-	-	-	-	**0**	**0**
Journal of Cardiothoracic and Vascular Anesthesia	12	13	20	14	11	18	17	29	32	37	35	29	26	**293**	**10.88**
Journal of Clinical Anesthesia	1	3	6	4	1	1	7	6	3	5	9	10	5	**61**	**2.26**
Journal of Neurosurgical Anesthesiology	2	3	1	2	2	1	1	1	3	2	2	3	2	**25**	**0.92**
Korean Journal of Anesthesiology	2	3	8	6	1	3	2	2	3	7	5	3	2	**47**	**1.74**
Medical Gas Research	-	-	-	-	-	-	-	-	-	-	-	1	-	**1**	**0.03**
Minerva Anestesiologica	2	3	3	5	10	7	8	6	6	8	3	4	6	**71**	**2.63**
Paediatric Anaesthesia	8	10	4	9	9	17	7	4	7	6	6	4	3	**94**	**3.49**
Perioperative Medicine	-	-	-	3	2	2	2	4	2	2	1	1	3	**22**	**0.81**
Revista Brasileira de Anestesiologia	-	2	2	1	1	3	5	3	-	-	-	-	-	**17**	**0.63**
Revista Colombiana de Anestesiologia	-	4	9	5	2	3	2	2	2	1	2	-	-	**32**	**1.18**
Revista Española de Anestesiologia y Reanimacion	2	4	7	9	8	31	11	6	8	6	4	5	3	**104**	**3.86**
Romanian Journal of Anesthesia and Intensive Care	-	-	-	-	-	-	-	-	2	-	-	1	-	**3**	**0.11**

Table II: Cont.

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total	%
Seminars in Cardiothoracic and Vascular Anesthesia	1	2	3	1	2	4	2	4	3	2	2	1	3	**30**	**1.11**
The Japanese Journal of Anesthesiology	2	9	9	7	6	4	8	3	-	-	-	-	-	**48**	**1.78**
The Journal of Education in Perioperative Medicine	-	-	-	-	-	-	-	-	-	-	-	-	-	**0**	**0**
Turkish Journal of Anaesthesiology and Reanimation	-	-	-	-	2	2	1	3	4	1	2	4	1	**20**	**0.74**
Total	**127**	**164**	**216**	**189**	**220**	**216**	**204**	**228**	**238**	**236**	**229**	**218**	**208**	**2693**	**100**

Table III: Number of Publications by Country

Country	Number of publications	Country	Number of publications
USA	917	Ireland	37
UK	618	Sweden	35
Canada	216	Greece	34
Switzerland	197	Hungary	27
Germany	178	Mexico	25
Australia	169	Russia	19
Austria	140	New Zealand	17
France	135	Poland	17
Holland	110	Portugal	15
Italy	103	Romania	15
Spain	96	Thailand	15
China	95	Iran	14
Denmark	87	Egypt	12
Belgium	79	Singapore	12
South Korea	67	Lithuania	10
Japan	66	Republic of Moldova	7
Brazil	62	Serbia	7
India	61	Bulgaria	6
Turkey	53	Croatia	5
Israel	48	Argentina	3
South Africa	41	Ukraine	3
Finland	40	Uganda	1

DISCUSSION

In the present analysis, anesthesiologists have published PBM studies; 2.63% among all subjects, particularly 2.75% of them published in anesthesiology journals in the recent 12 years which shows the rate of anesthesiologists' interest towards PBM in their clinical practice.

A hemoglobin value of less than 13 g dL^{-1} has been considered in the preoperative definition of anemia for both men and women prior to surgical procedures where substantial blood loss is anticipated (3-5). Postoperative anemia is more prevalent than preoperative anemia, which can affect up to 90% of patients following major surgery (6). Although anemia has nu-

merous possible underlying causes, iron deficiency is one of the most apparent causes (7). Mild anemia causes a decline in functional capacity and performance, and vitality, as well as in life quality (8).

In patients with preoperative mild to moderate anemia who underwent elective major non-cardiac surgery had a 35% increase in postoperative morbidity and a 42% increase in mortality. The modest or moderate preoperative anemia has been linked to myocardial infarction, stroke, progressive renal failure, or death within 30 days of surgery, as well as extended hospital stays (9,10). Preoperative anemic surgical patients have a potential to require allogeneic blood transfusion which cannot be considered risk free. Even worse preoperative anemia used to be treated with allogeneic blood transfusions without adequate consideration of the underlying cause or associated risks and benefits. If the chronic and underlying cause is not addressed, the correction will most likely be transient, and the anemia will reappear (11-13).

The use of blood products is associated with an increased risk of pulmonary, cardiovascular, neurological, renal, and oncological complications (14). There is an increase in adverse effects proportional to the dose of RBC transfusion. There have been reports of stroke and acute coronary syndrome, venous and arterial thromboembolism, and increased vasospasm. Eventually these complications could have extended hospital and intensive care unit stays, as well as long duration of mechanical ventilation. Hence, implementing a multidisciplinary, multimodal PBM program for surgical patients led to a 39% decrease in transfusion rates and, subsequently, a reduction in hospital length of stay, rate of complications, and mortality. The PBM continues through the postoperative period, addressing the triad of independent risk factors, including anemia, blood loss, and transfusion, which can influence the prognosis of surgical patients based on the three main pillars (15,16).

Soon after 6th World Health Assembly's decision to implement PBM in 2010, the number of global studies on PBM has increased year by year. Since it is crucial for anesthesiologists to reduce mortality and/or morbidity rates by application of PBM into their clinical practice, implementation of PBM has accelerated worldwide. Based on the very recent recommendations of the panelists of the international consensus conference on anemia management in surgical patients, all patients except those undergoing minor procedures should be screened for anemia before surgery and appropriate therapy should be guided by an accurate diagnosis of anemia etiology in elective surgical patients since early identification and effective treatment of anemia has the potential to reduce the risks associated with surgery and improve clinical outcomes. Additionally, postoperative anemia should be treated in the perioperative period (16,17).

Despite its huge potential to improve healthcare systems, PBM has not yet been adopted broadly. Therefore, semi-structured interviews of the collective experiences of a diverse group of PBM implementors across 12 countries from Asia, Latin America, Australia, Central and Eastern Europe, the Middle East, and Africa were analyzed. Responses reflecting the drivers, barriers, measures, and stakeholders regarding the implementation of PBM per country underwent qualitative content analysis. Summary of responses to current status and approach to implement PBM on national level varied among developed and developing countries including 12 countries. Developed countries showed mature and/or iniated-advanced status (18,19). Recently we have briefly shared implementation of PBM experience in Turkey along with the summary of present publication trend analysis to give a helpful message for potential PBM implementors (20).

CONCLUSIONS

We have gained valuable perspectives on the contributions of different journals to the advancement of medical knowledge by quantifying the distribution of publications among the journals. Anesthesiologists have demonstrated a commendable level of interest to publish PBM studies in journals dedicated to anesthesiology. In addition to the main goal of this study which was to provide information about the importance of this topic among the anesthesiologists by looking at the core anesthesiology journals presenting PBM-related articles in the last decade, we do care about increasing the awareness on the implementation of PBM either in international or national platform. We believe this research might be a helpful inspiration for those who need to initiate and/or advance PBM implementation.

AUTHOR CONTRIBUTIONS

Conception or design of the work: NCE, DBG
Data collection: NCE
Data analysis and interpretation: NCE
Drafting the article: NCE
Critical revision of the article: NCE, DBG
Other (study supervision, fundings, materials, etc): DBG
The author (NCE, DBG) reviewed the results and approved the final version of the manuscript.

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