

A Scientometric analysis of resuscitative endovascular balloon occlusion of the aorta (reboa) articles: Where do we stand?

A scientometric analysis of reboa articles

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Abstract

Aim: The aim of this study is to reach the data related to resuscitative endovascular balloon occlusion of the aorta (REBOA) through the Web of Science database, to make a scientometrics analysis of the data and to guide the researchers.

Material and Methods: All articles related to REBOA were reviewed on the Web of Science database. Articles were ranked according to the top 10 most published countries. All articles were analyzed through the database. In addition, the top 20 journals in which the most articles were published were listed according to their publication numbers. All articles were analyzed according to article type and subject headings. Abstracts of the top 10 most cited articles were prepared.

Results: The country with the most publications on REBOA was the United States (US). When we examine the journals that publish the most REBOA articles, the Journal of Trauma and Acute Care Surgery ranks first with 130 publications. Most of the 419 articles were found to have been published in the original article type. It has been observed that the studies have mostly focused on the clinical use of REBOA.

Discussion: There is a need for more comprehensive studies on the use of REBOA and its complications.

Keywords

REBOA, Scientometric Analysis, Journals

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Introduction

Resuscitative endovascular balloon occlusion of the aorta (REBOA) is a method in which a balloon is sent to the aorta with the help of a catheter and inflated and distal blood flow is prevented [1]. Although the frequency of use has increased in recent years, it was first used in the 1950s [2]. It has been used as an alternative to clamping the aorta, especially in non-compressible torso hemorrhagic patients. REBOA reduces bleeding, similar to clamping of the aorta after thoracotomy, allowing resuscitation and control of bleeding [3]. In addition, it is a less invasive method compared to thoracotomy and increases myocardial and cerebral blood flow by decreasing distal blood flow, just like clamping the aorta [1]. Especially in the last 10 years, REBOA has been re-entered into clinical use and it has been observed that many studies have been published on the use of REBOA. These studies have been and continue to be carried out in many areas from the training of REBOA to its application methods, clinical use, and experimental animal studies. Although many studies have been conducted in this field, information about REBOA is still limited.

Scientometrics is a discipline that statistically and mathematically analyzes technological and scientific data [4,5]. It is also referred to as the science of science. It sheds light on the researchers' awareness of gaps and knowledge gaps in a certain field and what subjects they should focus on [6]. In a literature search, scientometric analyzes were carried out in many scientific subjects and were determined to provide direction to researchers.

The Web of Science (WoS) database is a platform that allows researchers to access scientific and statistical data on certain subjects. It allows researchers to access publications and data on certain topics. The increase in the use of REBOA in recent years has allowed studies on many different subjects. However, when we look at the literature, there is no detailed data about these studies. The aim of this study is to reach the data related to REBOA through the WoS database, to make scientometrics analysis of them and to guide the researchers. Thus, it is thought that researchers will contribute to the elimination of deficiencies in the literature by deciding on which subjects they will focus on, and they can focus on different issues related to the use of REBOA.

Material and Methods

On January 2, 2023, all articles related to "Resuscitative Endovascular Balloon Occlusion of Aorta" were found in the WoS database by typing the keyword REBOA. This platform enables researchers to access scientific and statistical information on a particular subject and acts as a standard database for citation analysis because it provides more detailed information compared to other medical databases [7]. All articles related to REBOA were reviewed on the WoS database. Articles are ranked according to the top 10 most published countries. The number of citations of the published articles, the number of citations per publication for each country and H-Indexes were analyzed through the database. In addition, the top 20 journals with the most published articles in the database were listed according to the number of publications. The total number of citations by journals and the number of citations per article were examined.

The impact factor of the journals for 2021 was obtained from the journal websites. All articles published in the WoS database have been manually scanned through the WoS database. The titles, abstracts and full texts of the articles were examined. All articles were divided into topics such as the clinical use of REBOA, REBOA education, general clinical information about REBOA, prehospital use of REBOA, REBOA indications, REBOA-related animal experiments, REBOA complications, and REBOA administration and techniques. Subsequently, these articles were divided according to article types, namely: "Original Articles", "Reviews", "Proceeding Papers", "Case Reports" and others. All reviewed articles were analyzed according to article type and subject headings.

In addition, the articles were listed according to the number of citations on the WoS database, and the top 10 most cited articles were examined in detail and their abstracts were prepared. The data were entered into the Microsoft© Excel Program and the results were given as numbers and percentages. Ethical approval is not required as no live subjects were included in the study and it is a meta-data analysis of published studies.

Results

When the keyword REBOA was typed into the WoS database, a total of 758 articles were obtained. Among these articles, articles with REBOA in the author's name, repetitive articles, articles not related to REBOA, and publications whose full text or explanatory abstract could not be reached were excluded from the study and a total of 692 articles were examined. In total, 15 articles were written in German, 2 in French, 1 in Czech, and 1 in Spanish. The remaining 673 articles were written in English. When the articles were ranked according to the most published countries on the WoS database, it was determined that the top 3 countries with the most publications on REBOA were the United States (US) (62.71%), Japan (11.56%) and England (8.52%). It was found that there were 434 publications in total from the US, 80 publications from Japan and 59 publications from England. The articles published in the US received a total of 7045 citations, while the articles published in Japan and England received 1271 and 1820 citations, respectively. It has been observed that the country with the highest number of citations per publication is England with 30.85. Most publications on REBOA were published in 2021.

When we examine the journals that publish the most about REBOA, the Journal of Trauma and Acute Care Surgery (J Trauma Acute Care Surg) comes first with 130 publications. This is followed by the Journal of Endovascular Resuscitation and Trauma Management (J Endovasc Resusc Trauma Manag) (n=68) and Shock (n=34). The most cited journal is Journal of Trauma and Acute Care Surgery with 3734 citations. World Journal of Emergency Surgery (World J Emerg Surg) and European Journal of Trauma and Emergency Surgery (Eur J Trauma Emerg Surg) are followed by 451 and 418 citations. The most cited journal per publication was found to be the World Journal of Emergency Surgery with 34.69. Information about the top 20 journals and top 10 countries with the most publications is shown in Table 1.

The 692 articles in the WoS database were manually scanned one by one and separated according to article types and content.

Table 1. Publication and citation status of the top journals and countries.

	Number of Articles	Total Citations (%)	Citations per Publication
Countries (H-Index)			
The United States (43)	434 (62.71%)	7,045	16.23
Japan (19)	80 (11.56%)	1,271	15.89
England (19)	59 (8.52%)	1,82	30.85
Sweden (15)	56 (8.09%)	825	14.73
Canada (10)	37 (5.34%)	482	13.3
Colombia (12)	36 (5.20%)	407	11.31
Scotland (15)	26 (3.75%)	988	38
Germany (7)	25 (3.61%)	115	4.6
Italy (8)	16 (2.31%)	314	19.63
South Korea (5)	15 (2.6%)	67	4.47
Journal (Abbreviation/ Impact Factor)			
Journal of Trauma and Acute Care Surgery (J Trauma Acute Care Surg /3.697)	130	3734	28.72
Journal of Endovascular Resuscitation and Trauma Management (J Endovasc Resusc Trauma Manag/N/A)	68	125	1.84
Shock (Shock/3.533)	34	263	7.74
European Journal of Trauma and Emergency Surgery (Eur J Trauma Emerg Surg/2.374)	29	418	13.93
Injury International Journal of the Care of the Injured (Injury/2.687)	21	212	10.1
Journal of Surgical Research (J Surg Res/2.417)	18	285	15.83
Journal of American College of Surgeons (J Am Coll Surg/6.532)	16	317	19.81
Resuscitation (Resuscitation/6.251)	15	336	22.4
Trauma Surgery Acute Care Open (Trauma Surg Acute Care Open/ N/A)	15	168	11.2
The American Surgeon (Am Surg/1.002)	14	70	5.0
World Journal of Emergency Surgery (World J Emerg Surg/8.165)	13	451	34.69
American Journal of Surgery (Am J Surg/ N/A)	8	138	17.25
Circulation (Circulation/39.918)	7	1	0.14
American Journal of Emergency Medicine (Am J Emerg Med/4.093)	6	94	15.67
BMJ Military Health (BMJ Mil Health/2.8)	6	6	1
Journal of Emergency Medicine (J Emerg Med /1.473)	6	66	11
Journal of Maternal Fetal Neonatal Medicine (J Matern Fetal Neonatal Med /2.398)	6	34	5.67
Journal of the Royal Army Medical Corps (J R Army Med Corps/ 1.285)	6	69	11.5
Military Medicine (Mil Med/ 1.563)	6	61	10.17
Notfall+ Rettungsmedizin (Notfall Rettungsmed /0.892)	6	26	4.33

Table 2. Distribution of articles according to categories.

Article Type/ Subject Headings	Original Article	Review Article	Proceeding Papers	Case Reports	Othe	Total
Clinical Use	171	35	29	47	41	323
Reboa Training	22	1	0	0	3	26
General Clinical Information about Reboa	22	12	2	0	7	43
Pre-hospital Use	13	3	0	1	2	19
Reboa Indications	25	8	8	3	2	46
Animal Trials of Reboa Use	82	1	11	0	3	97
Reboa Complications	26	10	8	13	3	60
Reboa Application and Techniques	58	4	8	1	7	78
Total	419	74	66	65	68	692

Table 3. Summary of top ten articles about REBOA.

Article Information	Category	Country	Times Cited	Summary
Stannard A, et al. Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) as an Adjunct for Hemorrhagic Shock. Journal of Trauma and Acute Care Surgery	Review	The US	338	A review and a guideline describing the procedure in 4 steps
Brenner ML, et al. A clinical series of resuscitative endovascular balloon occlusion of the aorta for hemorrhage control and resuscitation. Journal of Trauma and Acute Care Surgery	Case Series	The US	292	A case series of 6 patients (4 blunt, 2 penetrating trauma) with hypotension undergoing REBOA. The procedure lasted an average of 18 minutes. The authors state that there was no mortality due to hemorrhage. They also state that they have not determined any REBOA-related complications.
Moore LJ, et al. Implementation of resuscitative endovascular balloon occlusion of the aorta as an alternative to resuscitative thoracotomy for noncompressible truncal hemorrhage. Journal of Trauma and Acute Care Surgery	Original Article	The US	219	Comparison of resuscitative thoracotomy (RT) with aortic cross-clamping and REBOA in patients with a potential of hemorrhagic shock. There were no differences between the RT group (n=72) and the REBOA group (n=24) in terms of demographics, injury mechanism, Injury Severity Scores and Abbreviated Injury Scale scores. REBOA was found to be effective in preventing early deaths and had an improved overall survival rate.
Morrison JJ, et al. A systematic review of the use of resuscitative endovascular balloon occlusion of the aorta in the management of hemorrhagic shock. Journal of Trauma and Acute Care Surgery	Review	Scotland	186	Systematic review of 41 articles on REBOA. It was concluded that the overall mortality of REBOA was 49.4%. Any reduction in hemorrhage-related mortality could not be identified. Besides, REBOA helped elevate central blood pressure in shock.
Saito N, et al. Evaluation of the safety and feasibility of resuscitative endovascular balloon occlusion of the aorta. Journal of Trauma and Acute Care Surgery	Original Article	Japan	163	Twenty-four patients with blunt trauma who underwent REBOA were included. Of these patients, 7 had a 30-day survival rate of 29.2%. Complications were observed in 3 cases. The authors underline the contribution of REBOA to survival and warn about the complications of the technique.
Coccolini F, et al. Pelvic trauma: WSES classification and guidelines. World Journal of Emergency Surgery.	Review	Italy	158	The role of REBOA is being discussed in pelvic trauma patients. The authors conclude that REBOA may be useful as a bridge to definitive treatment. The zone of balloon placement must be estimated carefully. In order to prevent complications, partial or/and intermittent REBOA should be considered.
Walter L. Biffl. The role of REBOA in the control of exsanguinating torso hemorrhage. Journal of Trauma and Acute Care Surgery.	Opinion	Colorado	152	A review of the efficacy of REBOA in hemorrhage of the noncompressible parts of the body such as thoracic, abdominal and pelvic regions
Brenner M, et al. Resuscitative Endovascular Balloon Occlusion of the Aorta and Resuscitative Thoracotomy in Select Patients with Hemorrhagic Shock: Early Results from the American Association for the Surgery of Trauma's Aortic Occlusion in Resuscitation for Trauma and Acute Care Surgery Registry. Journal of American College of Surgeons.	Original Article	Maryland	142	A total of 285 patients (202 patients underwent resuscitative thoracotomy, 83 patients underwent REBOA) were enrolled in the study. In REBOA patients, the success rate was 94%.
Norii T, et al. Survival of severe blunt trauma patients treated with resuscitative endovascular balloon occlusion of the aorta compared with propensity score-adjusted untreated patients. Journal of Trauma and Acute Care Surgery	Original Article	The US	133	Patients who received REBOA and who did not were compared in terms of mortality
Brenner M, et al. Basic endovascular skills for trauma course: Bridging the gap between endovascular techniques and the acute care surgeon. Journal of Trauma and Acute Care Surgery	Original Article	Maryland	132	A pre- and post-course questionnaire was administered to surgeons after a virtual reality simulation of REBOA. It was concluded that damage control endovascular procedures could be effectively taught using virtual reality simulation.

It was determined that while most 419 articles were published in the original article type, they were followed by review (n=74) articles. It has been observed that the studies mostly focused on the clinical use of REBOA. While the most studied topic was related to clinical use with 323 publications, it was followed by publications on animal studies with 97 publications. Data related to the subject content and article types of the articles published on REBOA are shown in Table 2. In addition, the top 10 most cited articles on REBOA are summarized in Table 3.

Discussion

Although REBOA is a method that has become more popular and frequently used in recent years, the clinical use of REBOA dates back more than 50 years. When the literature is examined, Edwards W.D, et al. conduct studies on balloon occlusion of the aorta [2]. When the WoS database is examined, it is seen that studies on REBOA have been included in this database since 2011. When we examine the studies carried out since 2011, it is seen that more than half of the studies (62.71%) were extracted from the US, and these studies were mainly published between 2019-2021. In the light of these data, it is observed that the majority of the contributions to the literature on the REBOA method, whose effectiveness and use have increased in recent

years, come from the US. It is seen that even Japan (11.56%), which ranks 2nd after the US, lags far behind the US. When we examine the journals in which studies on REBOA are published, it is seen that most publications are in the Journal of Trauma and Acute Care Surgery (n=130). Again, it is seen that the Journal of Trauma and Acute Care Surgery is in the 1st place in terms of the number of citations (n=3734) and in the 2nd place in the number of citations per publication (n=28.72). When we examine the top 10 most cited journals, it is known that 8 of them are also included in the Journal of Trauma and Acute Care Surgery. According to information obtained from the journal's own website, the Journal of Trauma and Acute Care Surgery is a publication that includes articles related to the care of patients who are severely injured or in critical condition due to surgical diseases. It is thought that the subject areas of the journal, the impact factor and the frequency of publication may have been effective in the selection of this journal by the authors. When the studies on REBOA are compared with other journals, it was found to be the leading journal on REBOA and has made great contributions to the literature. Considering the number of publications (n=68) in the Journal of Endovascular Resuscitation and Trauma Management, it is seen that it is in the 2nd place, while it is slightly behind in the number of citations (n=125)

and the number of citations per publication (n=1.84). Although the World Journal of Emergency Surgery ranks 11th in terms of the number of publications (n=13), it is seen that it ranks second in the number of citations (n=451) and ranks first in the number of citations per publication (n=34.69). It is known that a high citation count is an important parameter that shows the effectiveness of an article [8]. Although the number of publications is low, the high number of citations is accepted as a criterion for publishing qualified publications.

If we look at the article type and content of the publications related to REBOA, it is seen that the publications related to clinical use (n=323) and Original Article type (n=419) are mostly published. Of the publications on the clinical use of REBOA, 171 were original articles. Again, 35 of the publications related to its clinical use were in the form of review articles, while 47 of them were case reports. Morrison JJ et al., in their review-type study examining case reports on the clinical use of REBOA in hemorrhagic shock patients, stated that the use of REBOA did not increase mortality, but larger studies were needed to reduce mortality [1]. In a study conducted by Moore LJ, et al. in the original article type, in which they compared resuscitative thoracotomy and REBOA, they showed that mortality was reduced in patients using REBOA [3]. When the studies on REBOA are examined, it is seen that studies on animal experiments (n=97) are in second place. This shows that although the first use of REBOA is very old, the experience with REBOA is not very sufficient yet and experimental studies are still continuing to a large extent. When the studies on the complications of REBOA are examined, it is seen that only 26 of them are studies in the original article type. The majority of the remaining studies consist of review Studies in the form of case reports and examination of the studies. There is still a need for more studies on REBOA complications.

When the studies on REBOA training were examined, it was determined that there were 26 studies in total. In a study, it was mentioned that REBOA simulations and information learned from previous experiences are vital to improve patient care [9]. There are still questions about who and how often REBOA training will be given. In a study by Park et al., they emphasized the importance of frequent training and mentioned that surgical trainees were more successful in applying REBOA. However, they did not mention a clear period of how often it will happen [10]. Large-scale studies are still needed on how often and to whom REBOA training will be given. When the studies on the prehospital use of REBOA are examined, it is seen that there are 19 studies in total, and 13 of them are original articles. When studies are examined, it has been shown that REBOA may be effective in prehospital use [11-13]. In a study by Lendrum R, et al., they showed that REBOA is an effective method for prehospital use in patients with pelvic trauma without external bleeding [14].

However, prospective studies with larger populations are needed because the studies are mostly small case groups and retrospective studies. In addition, studies have not been able to make a clear definition of which patients would be suitable for REBOA use in the pre-hospital setting.

Limitations

Our study also has some limitations. Due to the nature of

scientometric studies, the results may differ according to the period in which it was conducted. In addition, the data used in this study are data obtained from the WoS database. Therefore, there may be numerical differences between the data made by manually scanning and the database data. Again, since the scans of the articles are done manually, there may be overlooked articles. However, since such losses are relatively small, they do not affect the results of the study.

Conclusion

In conclusion, REBOA is accepted as a method that has increased in popularity and use in recent years. However, there is still no clear information about the conditions under which REBOA will be used and its complications. In particular, when the literature is examined, it is seen that case reports and reviews about the complications of REBOA are predominant. Still, questions remain about how often and to whom REBOA training will be given. More comprehensive studies are needed on these issues. However, it is seen that REBOA will take more place in our lives in a very short time and will become an indispensable part of resuscitation, especially in hemorrhagic shock patients.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

The authors declare no conflict of interest.

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