ORIGINAL ARTICLE

Top 100 cited articles in traumatology: A bibliometric analysis

Mehmet Dokur, M.D.,[1] Erdal Uysal, M.D.[2]

[1]Department of Emergency Medicine, Biruni University Faculty of Medicine, İstanbul-*Turkey*
[2]Department of General Surgery, Sanko University Faculty of Medicine, Gaziantep-*Turkey*

ABSTRACT

BACKGROUND: In this bibliometric study, we aimed to conduct multi-dimensional citation analysis of the top 100 cited articles in traumatology.

METHODS: We analyzed the top 100 cited articles among 56.980 trauma articles published between 1975 and 2017, which we obtained from databases in Web of Science and PubMed based on their citation rates and publication years, countries of origin, institutions or organizations, the most common subjects, funding status, article types, and levels of evidence.

RESULTS: In the top 100 cited articles, the number of total authors was 649 and average authorship was 6.49±5.46 (1–32); group author or study group number was eight, and the number of total collaborators was 1241. USA was the top country in terms of country of origin and institutions or organizations and also the number of proceedings papers in scientific activities. We found that 70 of the top 100 cited articles were supported by funding agencies in developed countries. In the present study, the three most common subjects were central nervous system trauma (21 articles), major trauma–hemorrhage–bleeding control–transfusion–early coagulopathy (18 articles), and trauma care and systems (eight articles), respectively. The average level of evidence of the top 100 cited articles was 2.45±1.05 (range: 1–4). We also found that 66 of the 100 most frequently cited articles in traumatology were published in scientific journals that had an impact factor of ≥2.6 (range: 2.648–72.406). We found that the most commonly preferred article type by authors is clinical research (92 articles) and sub-type is prospective comparative studies (27 articles). Evidence groups of classical papers in traumatology were B (54 articles), A (26 articles), and C (20 articles), respectively.

CONCLUSION: Despite some flaws in determining the scientific values of articles, citation analysis of classical papers in traumatology can provide important scientific contributions.

Keywords: Articles; bibliometric; top-cited; traumatology.

INTRODUCTION

Trauma is the most prominent cause of death in children and young people.[1] Approximately 5.8 million people die each year as a result of injuries. This accounts for 10% of the deaths worldwide.[2] For this reason, traumatic injuries, which are frequently encountered in emergency services and surgical clinics, are important clinical and surgical problems that require a multidisciplinary approach.[3,4] Trauma is generally accepted as preventable mortal and/or morbid problems. However, in a 25-year evaluation, Campbell WB et al.[5] reported that the number of all emergency admissions increased with time, whereas mortality rates and hospitalization time reduced significantly. In this context, traumatology is a subject of study for scientific researches in epidemiological, diagnostic, therapeutic, and prognostic fields.[6,7]

Initially, in 1987, Garfield E introduced the concept of "citation classics" for the best-cited articles published in JAMA. In later years, many bibliometric article analyses were conducted in different fields of medicine.[8] Citation analysis of classical or top-cited articles regarding traumatology can significantly contribute to this field in terms of exhibiting up-to-date academic information, progress, and tendencies. However, there

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Address for correspondence: Mehmet Dokur, M.D.
Biruni Üniversitesi Tıp Fakültesi, Acil Tıp Anabilim Dalı, Beşyol Mah., No: 10, 34295 Florya, İstanbul, Turkey.
Tel: +90 212 - 411 39 00 / 1008 E-mail: mdokur@biruni.edu.tr

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are few bibliometric studies related to traumatology in the current literature.[9–11] In the present study, we systematically analyzed the top 100 cited articles "key papers or classic papers" according to data obtained from PubMed and Web of Science (WoS) in the field of traumatology. We determined the number of citations with ranking, citations and publications by years, publishing journals, type and sub-type of articles, institutions and countries of origin, the most common topic of frequently cited articles, and authorship status of classical papers in this bibliometric research.

MATERIALS AND METHODS

Study Design

Study type: Retrospective clinical research

Level of evidence: 3 or Group B (Scottish Intercollegiate Guidelines Network; SIGN).[12]

Data Collection and Inclusion Criteria

Data used in this bibliometric citation analysis was obtained from Thomson Reuters' WoS Core Collection database (Philadelphia, Pennsylvania, USA) and PubMed (US National Library of Medicine-National Institutes of Health). We accessed the WoS database (accessed date: 23.03.2017) using the keyword "trauma" between 1975 and 2017. Consequently, we obtained 56.980 articles and conducted analysis of the top 100 cited articles among these results. We accessed the remaining data pertaining to the analyzed articles via PubMed. Two of the authors (M.D. and E.U.) independently identified the top 100 cited articles with consensus.

Being a first author or co-author was accepted as the authorship criterion in the present study. To shorten the obtained table, we limited quantitative values to "2 or more and 3 or more." The level of evidence of the top 100 cited articles was detected in accordance with SIGN criteria.[12] Accordingly, Group A evidence (levels 1a and 1b) comprised randomized clinical trials (RCT) or meta-analysis of RCT. Group B evidence (levels 2a, 2b, and 3) comprised cohort studies, case–control studies, and comparison of two or more groups where data were collected retrospectively, as well as semi-experimental studies. Group C evidence (level 4) comprised case series and expert opinions or expert committee reports (excluding levels 1 and 3 evidence). Group D evidence (level 5) comprised case reports.

Statistical Analysis

Descriptive statistical methods were used in the present study. All data are expressed as a percentage, number, bar chart, or mean±standard deviation in the tables.

Ethical Statement

All authors declare that the research was conducted according to the principles of the World Medical Association Declaration of Helsinki "Ethical Principles for Medical Research Involving Human Subjects." This study did not need to be approved by an ethics committee because it performed a bibliometric analysis or citation analysis of existing published classical studies.

RESULTS

Contributions, Attributions, and Research Groups

We detected the citation average of the top 100 cited articles in traumatology as 430.06±172.7 (range: 257–1108), and the sum of self-citation was 139 (according to Thomson Reuters' WoS Core Collection). The publishing language was English for all articles. We found that the most cited article (times cited: 1108) in traumatology is the review by Boyd CR et al. on trauma scoring systems with the following topic: "Evaluating trauma care: the TRISS method. Trauma Score and the Injury Severity Score. J Trauma 1987;27:370–8." The least cited article (times cited: 257) in traumatology was another review by Leker RR and Shohami E who studied different etiological approaches on cerebral ischemia and trauma with the following title: "Cerebral ischemia and trauma-different etiologies yet similar mechanisms: neuroprotective opportunities. Brain Res Rev 2002;39: 55-73" (Appendix 1). Among the 100 most influential manuscripts, the number of group authors or study groups was eight (CRASH-2 Trial Collaborators with two studies, 39 authors, and 1128 collaborators; Pediatric Emergency Care Applied Research Network with one study, 32 authors, and 109 collaborators; Working Group on Polytrauma of the German Trauma Society with one study, nine authors, and four collaborators; RECORD Trial Group with one study and 14 authors; EURODEM Risk Factors Research Group with one study and 10 authors; AG Polytrauma of the German Trauma Society (DGU) with one study and nine authors; Novoseven Trauma Study Group with one study and eight authors; and National Emergency X-Radiography Utilization Study Group with one study and five authors). In addition, the number of total authors and collaborators was 126 and 1241, respectively, in these study groups (according to Thomson Reuters' WoS Core Collection). Analyses of the publications (between 1980 and 2013) and citation rates in

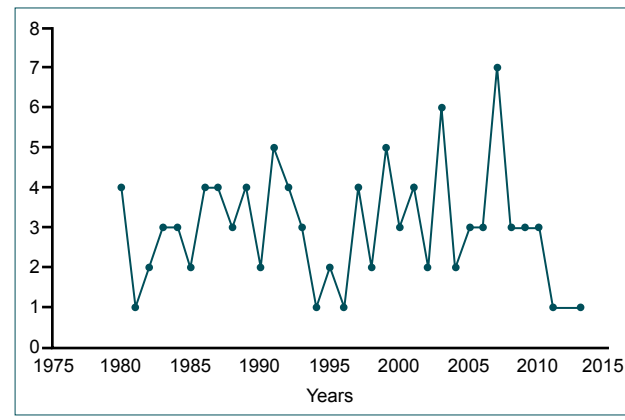

Figure 1. The top 100 cited articles published in each year (1980–2013).

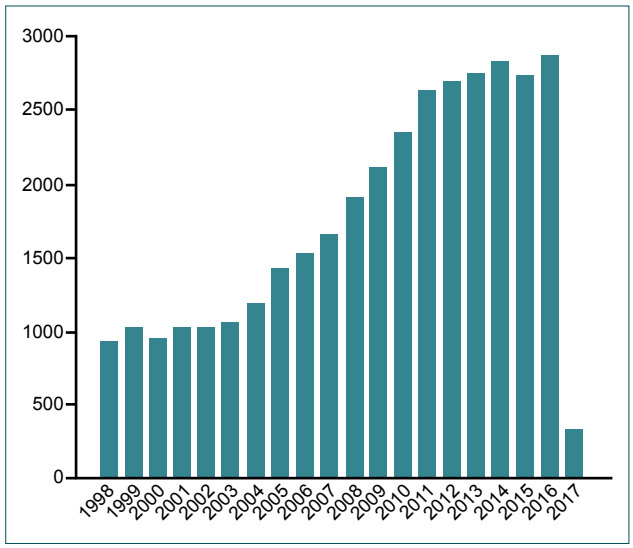

Figure 2. Citations in each year (last 20 years, source: Web of Science database).

each year (between 1998 and 2017) of "key papers" in traumatology found that the highest number of publications was seen in 2007 (seven publications) and the highest number of citations was seen in 2016 (2875 citations) (Figs. 1 and 2).

Authorship

The total number of authors of "classic papers" included in our study was 649, and average authorship in the classics in traumatology was 6.49±5.46 (1–32) (according to Thomson Reuters' WoS Core Collection and PubMed). We analyzed the distribution of 20 authors who were included in more than three articles among the top 100 cited articles and found that the first three ranks were shared by Hoyt DB, Moore EE, and Moore FA, with five articles each. In addition to this, we observed that the most frequent first author of key papers included in our research was Campion HR with four articles, and Hoyt DB, Moore EE, and Copes WJ were detected to be the most frequent co-authors, with four articles each. In addition, Hoyt DB and Moore EE were included as first authors in one article. In addition, we also found that the number of authors included in two articles was 53 (Table 1).

Countries and Institutions or Organizations

The three most common listed countries with two or more publications in the top 100 cited articles were USA (69%), England (13%), and Germany (11%), respectively. In total, 20 countries were listed 155 times in the top 100 cited articles (range: 2–69) (Table 2). In the present study, we determined that the most common listed institution or organization was the University of California (USA), and it was listed 34 times in the top 100 cited articles. Moreover, the number of institutions or organizations that published three or more publications was determined to be 21/31 (67.7%) of them were in USA (Table 3).

Table 1. The most common authors with two or more in the top 100 cited articles

Author	Affliation	Number
Hoyt DB	University of Maryland Medical Center, Baltimore (USA)	5
Moore EE	Denver Health Medical Center, Colorado (USA)	5
Moore FA	USAISR, Fort Sam Houston, TX 78234-6315 (USA)	5
Bouillon B	RWTH University Hospital Aachen, Aachen (Germany)	4
Brohi K	University of Maryland Medical Center, Baltimore (USA)	4
Champion HR	USAISR, Fort Sam Houston, TX 78234-6315 (USA)	4
Jurkovich GJ	Johns Hopkins Bloomberg School of Public Health, Baltimore (USA)	4
Trunkey DD	University of North Carolina, North Carolina (USA)	4
Copes WS	Washington Hospital Center, Washington DC (USA)	4
Hunt BJ	RWTH University Hospital Aachen, Aachen (Germany)	4
Croce MA	University of Tennessee, Memphis (USA)	3
Fabian TC	University of Tennessee, Memphis (USA)	3
Hall ED	Parke-Davis Pharmaceutical Research, Michigan (USA)	3
Holcomb JB	University of Maryland Medical Center, Baltimore (USA)	3
Lefering R	Ludwig-Maximilians-University, Munich (Germany)	3
Neugebauer E	RWTH University Hospital Aachen, Aachen (Germany)	3
Rivara FP	Johns Hopkins Bloomberg School of Public Health, Baltimore (USA)	3
Rossaint R	RWTH Aachen University Hospital, Aachen, (Germany)	3
Sacco WJ	Washington Hospital Center, Washington, DC (USA)	3
Wade CE	United States Army Institute of Surgical Research, Tt Sam Houston (USA)	3

Table 2. The most common listed countries with two or more in the top 100 cited articles

Country	Number*
The United States of America	69
The United Kingdom	13
Germany	11
Canada	9
Netherlands	6
France	5
Scotland	5
Switzerland	5
Denmark	4
Israel	4
Australia	3
Austria	3
Spain	3
Sweden	3
Belgium	2
Czech Republic	2
Finland	2
Italy	2
Japan	2
Slovenia	2

*Number of times listed of total 20 countries in the top 100 cited articles.

Table 3. Institutions of origin with three or more in the top 100 cited articles

Rank	Institution	Number*
1	University of California, (USA)	34
2	University of Colorado (USA)	21
3	University of Washington (USA)	12
4	University of Toronto (Canada)	6
5	Witten Herdecke University (Germany)	6
6	University of Maryland (USA)	6
7	University of Michigan (USA)	6
8	Harvard University (USA)	5
9	San Fransisco General Hospital Medical Center (USA)	5
10	Boston University (USA)	4
11	Denver Health Medical Center (USA)	4
12	Oregon University (USA)	4
13	Sunnybrook Research Institue (Canada)	4
14	University of Pennsylvania (USA)	4
15	Washington Hospital Center (USA)	4
16	Ludwig Boltzmann Institute (Germany)	3
17	Mayo Clinic (USA)	3
18	Oregon Health & Science University (USA)	3
19	Pennsylvania Commonwealth System of Higher Education-PCSHE (USA)	3
20	Pfizer Co. (USA)	3
21	Royal London Hospital (England)	3
22	RWTH Aachen University (Germany)	3
23	State University of New York (USA)	3
24	United States Army (USA)	3
25	United States Department of Defense (USA)	3
26	University of Glascow (UK)	3
27	University of Medicine and Dentistry of New Jersey (USA)	3
28	University of Pittsburgh (USA)	3
29	University of Southern California (USA)	3
30	University of Tennessee (USA)	3
31	University Hospital Zurich (Switzerland)	3

*Number of times listed of total 31 institutions in the top 100 cited articles.

Funding

In addition to this, we also detected that 70 of the top 100 cited articles in traumatology, which are considered "topic trends," received funding support from 47 different funding agencies, and it was observed that the funding agencies that supported these scientific studies were NINDS NIH HHS (seven studies), NIGMS NIH HHS (six studies), and PHS HHS (four studies) (according to Thomson Reuters' WoS Core Collection).

Journals and Proceedings Papers

In the present study, 66 of the top 100 cited articles were published in journals that had an impact factor (IF) of ≥2.6 (range: 2.648–72.406, according to Clarivate Analytics, 2017). In addition, we also found that "The Journal of Trauma and Acute Care Surgery" (previously known as "The Journal of Trauma Injury Infection and Critical Care," which was sponsored from the beginning by the American Association for the Surgery of Trauma; AAST) had the highest number of publications (23 publications; Table 4). Moreover, we observed that the number of proceedings papers among the top 100 articles in 16 national and international scientific activities was 17, and the most presented proceedings paper was at the "56th Annual Meeting of the AAST" (date: September, 19–21, 1996; Houston TX, USA) (according to Thomson Reuters' WoS Core Collection).

Main subjects

The three most common topics among the top 100 cited articles in traumatology were central nervous system (CNS) trauma (21 articles), major trauma–hemorrhage–bleeding control–transfusion–early coagulopathy (18 articles), and

Table 4. List of journals in which two or more published articles

Rank	Journal	Number of articles	Impact Factor (2016)*
1	The Journal of Trauma and Acute Care Surgery	23	2.802
2	Annals of Surgery	9	8.980
3	The Lancet	8	47.831
4	The New England Journal of Medicine	6	72.406
5	Journal of The American Medical Association	5	44.405
6	The Journal of Critical Care	3	2.648
7	Critical Care Medicine	2	7.050
8	Free Radical Biology & Medicine	2	5.606
9	Journal of Neuroscience	2	5.988
10	Journal of Neurotrauma	2	5.190
11	Neurology	2	7.592
12	Science	2	37.205

*2016 Journal Citation Reports® (Clarivate Analytics, 2017).

trauma care–trauma care systems (eight articles), respectively (Table 5).

Study Types and Levels of Evidence

In addition, among the top 100 "classic papers" in traumatology, the most preferred study type among researchers was clinical studies (92 articles) and the most preferred sub-type was prospective comparative studies (27 articles). In our study, the mean level of evidence was found to be 2.45±1.05 (1–4). In addition, evidence group of 54 articles were (prospective/retrospective comparative studies, retrospective cohort studies, case–control studies, descriptive studies, cross-sectional studies, and validation studies), and evidence group of 26 articles was A (meta-analysis of RCT, systematic review, RCT, and prospective cohort study). Lastly, the level of evidence of 20 articles were C group (reviews, expert committee reports, and expert opinions) (Table 6).

DISCUSSION

Trauma or injury with its beforemath and aftermath is a complex series of events that include victims. In recent years, new concepts that prioritize cost-effectiveness, such as damage control resuscitation and damage control surgery, are increasingly becoming widespread.[13,14] Trauma has different types of etiologies and pathophysiological mechanisms based on its type.[15,16] Moreover, acoustic trauma should not be forgotten. However, very few bibliometric studies have been conducted in the field of traumatology. Thus, we prioritized conducting a study on this subject.

We preferred to conduct such a bibliometric study for the beginning in the field of traumatology. Although frequently criticized, particularly in terms of its statistical results, bibliometric citation analyses provide important clues about the current best-cited or landmark articles to researchers because it reflects scientific improvements in the respective field and landmark papers and topic trends in a chronological perspective and in a systematic manner.[8,17,18] In the last 30 years, many bibliometric article analyses have been conducted in the field of clinical medicine.[19–21] Scientometric analyses, which include altmetric scores at different publication levels or values, have also been added to these studies in recent years.[22]

We utilized current medical databases, primarily the WoS database and PubMed, in our bibliometric analysis. Despite the fact that many international medical databases (including PubMed, ScienceDirect, Medline, Scopus, Embase, EBSCO Host, etc.) have been used in citation analysis studies, the most frequently used source is Thomson Reuters' WoS Core Collection. The WoS database includes important information in terms of detecting citations and researching other relevant academic effects.[23] Thus, to conduct this bibliometric study on the 100 most influential manuscripts, as in many similar types of researches.

It is also evident that the citation rates of articles are high and the citation range has a narrow distribution in this bibliometric study. This may be because studies conducted on attractive subjects of traumatology, such as evaluating trauma care, which has multiple effects and results, are high in number and also that produced articles are published in journals with high IFs; therefore, there are many citations. A scientific article being cited frequently and being published in journals with high IFs might be a significant indicator of its quality. In addition to this, there are many factors apart from the number of citations.[24] Being the first and original article in the respective field, which provides insight to researchers working in that field, is only of these other factors.[25] In a research

Table 5. The most common topics among the top 100 cited articles

Topic	Number
Central nervous system trauma	21
Major trauma–hemorrhage–bleeding control–transfusion–early coagulopathy	18
Trauma care	8
Major trauma–infection–sepsis	6
Abdominal trauma–feeding–septic mortality–gut bacterial translocation–decontamination	6
Fracture–dislocation–extremity trauma–hand wrist cumulative trauma disorder	6
Trauma score	3
Spinal cord trauma	3
Acoustic trauma	3
Trauma–venous thromboembolism	3
Traumatic deaths	2
Severe blunt trauma–ARDS–hemorrhagic shock–cytokine patterns	2
Trauma–postoperative fibrinolytic shutdown	2
Abdominal trauma–abdominal compartment syndrome	1
Abdominal trauma–staged laparotomy	1
Hepatic blunt trauma management	1
Major trauma–parachute use	1
Torture–trauma–posttraumatic stress disorder	1
Vascular trauma–endothelial precursors	1
Major trauma–plasma fibronectin (opsonic glycoprotein) levels	1
Trauma–surgery–the stress response	1
Multiple trauma–sedation–mortality	1
Trauma–whole body CT–survivre	1
Trauma–rheumatoid arthritis–matrix metalloproteinases	1
Obstetric trauma–vaginal delivery	1
Blunt aortic injury	1
Accidental and intentional injuries	1
Trauma–orthopedic–spinal implants–PEEK biomaterials	1
Trauma hypothermia	1
Trauma–inflammation–microbes–thymic stromal lymphopoietin	1

on 5-year citation reports of cardiovascular articles, Ranasinghe I et al.[26] stated that few citations might be due to many factors, including article and publication period. However, the fact that many have cited an article does not necessarily indicate a high level of evidence, and a positive correlation between productivity in terms of scientific activity and high citation is also not necessary.[27] Some authors have even suggested scientist' IF and metric evaluation scores in addition to the H-index, total IF, and citation number for evaluating a researcher's scientific activity.[28]

Factors such as the number of citations being in favor of old journals and publications, scientific articles not cited within 1–2 years after their publication, and post-publication citation peak being between 3 and 10 years and articles losing their importance after that period are the main limitations in determining the value of articles in citation classics studies.[8,25] This effect was only partially displayed in our bibliometric research because researches cited in 2016, in which the number of citations peaked, were published 5–15 years ago.

The highest cited article and the second most common type of article being review studies in this bibliometric research is a typical example of that assumption. In his study, Garfield E[17] underlined that most of the highly cited articles were review studies.

Articles analyzed in our bibliometric study had a relatively higher average authorship rate [6.83±5.49 (1–32)] because the level of evidence was predominantly A and B groups (80%). Moreover, there were fewer observational studies, and most of these studies were extensive, while some of them were multi-centered. Furthermore, author groups were conducted with collaborators. A study by Tilak G et al.[29] on authorship increments in scientific researches revealed that the number of observational studies decreased in three major international journals between 1960 and 2010, whereas there was a significant increase in single- and multi-center RCTs; however, the rate of author per article increased more than three times for observational studies (2.6 to 10.1). In this context, the results of our study are partially compatible with the results of the research conducted by Tilak G et al. particularly in terms of the increment reported in observational researches.

According to our research data, among the 100 most influential manuscripts in traumatology both in terms of the number of authors who were included in more than one article and the number of presented proceedings papers and scientific activities, USA is at the forefront.[23,30]

The publication language of all classics papers included in our citation analysis research was English. The official language of the country of origin of publications is an important factor for the selection of language for articles. Although different languages were used, most of the articles in the recent medicine literature were in English.[31]

We have underlined in our bibliometric study that institutions or organizations located in USA are more prominent both in terms of the number of institutions producing publications and in terms of the number of publications per institution. USA has

Table 6. Study design and levels of evidence by SIGN of the top 100 cited articles

Study type and sub-type	Level of evidence	Group	Number
Clinical research			
Meta-analysis of RCT	1	A	2
Systematic review	1	A	4
Randomized controlled trial	1	A	14
Prospective cohort study	1	A	6
Prospective comparative study (clinical)	2	B	18
Retrospective comparative study (clinical)	3	B	3
Retrospective cohort study	3	B	11
Case–control study	3	B	6
Observational–descriptive study	3	B	2
Cross-sectional–correlation study	3	B	4
Validation study	3	B	1
Review	4	C	15
Expert committee report	4	C	2
Expert opinion (editorial, letter, and note)	4	C	3
Experimental animal study			
Prospective comparative study	2	B	9

SIGN: Scottish Intercollegiate Guidelines Network; RCT: Randomized control trial.

the highest production of scientific publications, including in medicine and other health science fields. USA has the highest number of scientific publications in many fields.[23,30,31]

The result of our bibliometric study, which displays that most of the 70% of the 100 most influential manuscripts are being supported by funding agencies in USA and the EU, is a solid indicator of this hypothesis. Although the amount of allowance has reduced in recent years, educational and scientific studies are generally supported with funding at a greater extent in developed countries relative to developing countries.[32,33]

A high IF is an important scientometric criterion that demonstrates the quality of a journal.[34] As in our research, most of the top 100 cited articles in traumatology were included in journals with an IF of ≥2.6, which is an important indicator that displays that key papers pertaining to trauma are preferred by journals with higher IFs.

The most common topic in our study was CNS trauma. Traumatic brain injury (TBI) is a particularly important problem with socioeconomical and medical consequences among the young population in terms of its result.[35] Abusive head trauma is a typical example of this.[36] According to geographical regions, various incidences have been reported on the epidemiology of TBI.[37,38] Nguyen R et al.[39] conducted a systematic review and meta-analysis regarding this phenomenon; according to this, the international cumulative incidence rate of the TBI among all age groups is reported to be 295 of 100.000 people. The pooled annual incidence proportion for all ages was 295 per 100,000 (95% confidence interval: 274–317), and the international cumulative annual incidence speed is reported to be 349 of 100.000 people among all age groups. In light of this important information obtained from these studies, we conclude that CNS trauma is important among the fields of traumatology.

These were the second and third most common topics of our bibliometric study, and both of these trauma research subjects are based on the cost effectivity increasing concerns on traumatology. During the last few years, the correlation between trauma and bleeding and control of the bleeding earned an importance in the field of trauma research. Therefore, Damage Control Resuscitation and Damage Control Surgery concepts, which are related to trauma resuscitation can be seen as a typical reflection of this.[8,9] Again, in the last few years, trauma care and trauma care systems can be stated as other important trending traumatology subjects.[40]

Strengths

The strength of this study is the provision of a quick and direct reach to determine topic trends and up-to-date information regarding traumatology with no requirements of any advanced analysis or statistical methods.

Limitations

Only the total number of citations (excluding self-citations)

and the total number of self-citations are presented in this study, and no article-based self-citation analyses was performed, which is a limitation of this study. In addition, conducting bibliometric analyses based on citations is a subjective constraint to prove the quality of research and to determine the number of publications by year as well as to evaluate authors' scientific efficiency.

Future Directions

Occasional bibliometric analyses for different medical disciplines and sub-specialties demonstrate the improvements in that field from a nominative perspective, in contrast with advanced research methods. The data of current studies may provide cost effectivity in planning and funding of future research projects. Bibliometric studies are relatively subjective initial and basic researches in terms of scientific value. In the last decade, altmetric studies including multiple evaluations of classical articles were preferred as they are scientifically more objective.

Conclusion

Traumatology is an important surgical medicine discipline that is the subject of many topic trend researches. Despite its flaws, bibliometric citation analyses in traumatology, as in many scientific fields, enables the systematic identification of true landmark publications and the distribution of citations of these publications by years, main topics, institutions of influential papers, published scientific journals, research types and subtypes, and level of evidence, thus resulting in great academic contribution to traumatology.

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35. Kuppermann N, Holmes JF, Dayan PS, Hoyle JD Jr, Atabaki SM, Holubkov R, et al; Pediatric Emergency Care Applied Research Network (PECARN). Identification of children at very low risk of clinically-important brain injuries after head trauma: a prospective cohort study. Lancet 2009;374:1160–70. [CrossRef]
36. Jenny C, Hymel KP, Ritzen A, Reinert SE, Hay TC. Analysis of missed cases of abusive head trauma. JAMA 1999;281:621–6. [CrossRef]
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ORİJİNAL ÇALIŞMA - *ÖZET*

Travmatolojide en sık alıntılanan 100 makale: Bibliyometrik bir analiz

Dr. Mehmet Dokur,[1] Dr. Erdal Uysal[2]

[1]Biruni Üniversitesi Tıp Fakültesi, Acil Tıp Anabilim Dalı, İstanbul
[2]Sanko Üniversitesi Tıp Fakültesi, Genel Cerrahi Anabilim Dalı, Gaziantep

AMAÇ: Bu bibliyometrik çalışmada, travmatoloji alanındaki en sık alıntılanan 100 makalenin çok yönlü analizini yapmayı amaçladık.
GEREÇ VE YÖNTEM: Biz bu çalışmada, Web of Science ve PubMed'teki veri tabanlarından elde ettiğimiz, 1975 ile 2017 yılları arasında yayınlanmış 56.980 travma makalesi içinden en çok alıntılanan ilk 100'ünü alıntılanma sayılarına ve yayın yıllarına, köken aldığı ülkelere ve kurum veya organizasyonlarına, en sık tercih edilen konularına, fonlanma durumlarına, makale tiplerine ve kanıt düzeylerine göre analiz ettik.
BULGULAR: Travmatoloji alanında en sık alıntılanan 100 makaledeki toplam yazar sayısını 649 ve yazar sayısı ortalamasını 6.49±5.46 (dağılım: 1–32), toplam çalışma grubu sayısını 8 ve eşlik eden çalışmacı sayısını ise 1241 olarak saptadık. Amerika Birleşik Devletleri, yayınlarda en sık yer alan ülke ve kurum ya da organizasyon olma ve bilimsel aktivitede sunulan makale sayısı bakımlarından ilk sırada idi. En çok alıntılanan 100 makalenin 70'inin, gelişmiş ülkelerdeki fon desteği veren kuruluşlar tarafından desteklendiğini belirledik. Travmatoloji ile ilgili en çok alıntılanan 100 makalede en sık tercih edilen ilk üç konu başlığını santral sinir sistemi travması (21 makale), majör travma-kanama-kanama kontrolü-transfüzyon-erken koagülopati (18 makale) ve travma bakımı ve sistemleri (8 makale) olarak saptadık. En sık alıntılanan 100 travmatoloji makalesinin kanıt ortalaması 2.45±1.05 (dağılım: 1–4) idi. Ayrıca biz en çok alıntılanan 100 makalenin 66'sının etki faktörü 2.6 daha yüksek olan bilimsel dergilerde (dağılım: 2.648–72.406) yayınlandığını belirledik. Araştırmacılar tarafından en sık tercih edilen çalışma tipinin klinik araştırma (92 makale) ve çalışma alt tipinin ise karşılaştırmalı ileriye yönelik çalışmalar (27 makale) olduğunu saptadık. Travmatolojideki klasik makalelerin kanıt gruplarının dağılımlarını ise sırasıyla B (54 makale), A (26 makale) ve C (20 makale) olarak belirledik.
TARTIŞMA: Makalelerin bilimsel değerini saptamadaki bazı eksikliklerine rağmen travmatoloji alanındaki klasik makalelerin alıntılanma analizleri, önemli akademik katkılar sağlayabilir.

Anahtar sözcükler: Bibliyometrik; makaleler; travmatoloji; yüksek sayıda alıntılanma.

Ulus Travma Acil Cerrahi Derg 2018;24(4):294-302 doi: 10.5505/tjtes.2017.74857

Appendix 1. The top 100 cited articles in traumatology

Rank	Article	Times cited
1.	Boyd CR, Tolson MA, Copes WS. Evaluating trauma care: the TRISS method. Trauma Score and the Injury Severity Score. J Trauma 1987;27:370-8.	1108
2.	Sauaia A, Moore FA, Moore EE, Moser KS, Brennan R, Read RA, et al. Epidemiology of trauma deaths: a reassessment. J Trauma 1995;38:185-93.	992
3.	Champion HR, Sacco WJ, Copes WS, Gann DS, Gennarelli TA, Flanagan ME. A revision of the Trauma Score. J Trauma 1989;29:623-9.	937
4.	MacKenzie EJ, Rivara FP, Jurkovich GJ, Nathens AB, Frey KP, Egleston BL, et al. A national evaluation of the effect of trauma-center care on mortality. N Engl J Med 2006;354:366-78.	918
5.	Tator CH, Fehlings MG. Review of the secondary injury theory of acute spinal cord trauma with emphasis on vascular mechanisms. J Neurosurg 1991;75:15-26.	836
6.	Kudsk KA, Croce MA, Fabian TC, Minard G, Tolley EA, Poret HA, et al. Enteral versus parenteral feeding. Effects on septic morbidity after blunt and penetrating abdominal trauma. Ann Surg 1992;215:503-11.	764
7.	CRASH-2 trial collaborators (570 researchers), Shakur H, Roberts I, Bautista R, Caballero J, Coats T, Dewan Y, et al. Effects of tranexamic acid on death, vascular occlusive events, and blood transfusion in traumapatients with significant haemorrhage (CRASH-2): a randomised, placebo-controlled trial. Lancet 2010;376:23-32.	693
8.	Champion HR, Copes WS, Sacco WJ, Lawnick MM, Keast SL, Bain LW Jr, et al. The Major Trauma Outcome Study: establishing national norms for trauma care. J Trauma 1990;30:1356-65.	681
9.	Geerts WH, Code KI, Jay RM, Chen E, Szalai JP. A prospective study of venous thromboembolism after major trauma. N Engl J Med 1994;331:1601-6.	674
10.	Rappaport M, Hall KM, Hopkins K, Belleza T, Cope DN. Disability rating scale for severe head trauma: coma to community. Arch Phys Med Rehabil 1982;63:118-23.	671
11.	Marsh JL, Slongo TF, Agel J, Broderick JS, Creevey W, DeCoster TA, et al. Fracture and dislocation classification compendium - 2007: Orthopaedic Trauma Associationclassification, database and outcomes committee. J Orthop Trauma 2007;21(10 Suppl):S1-133.	642
12.	Mollica RF, Caspi-Yavin Y, Bollini P, Truong T, Tor S, Lavelle J. The Harvard Trauma Questionnaire. Validating a cross-cultural instrument for measuring torture, trauma, and posttraumatic stress disorder in Indochinese refugees. J Nerv Ment Dis 1992;180:111-6.	612
13.	Champion HR, Sacco WJ, Carnazzo AJ, Copes W, Fouty WJ. Trauma score. Crit Care Med 1981;9:672-6.	593
14.	Gill M, Dias S, Hattori K, Rivera ML, Hicklin D, Witte L,et al.Vascular trauma induces rapid but transient mobilization of VEGFR2(+)AC133(+) endothelialprecursor cells. Circ Res 2001;2-88:167-74.	587
15.	Saba TM, Jaffe E. Plasma fibronectin (opsonic glycoprotein): its synthesis by vascular endothelial cells and role in cardiopulmonary integrity after trauma as related to reticuloendothelial function. Am J Med 1980;68:577-94.	571
16.	Braughler JM, Hall ED. Central nervous system trauma and stroke. I. Biochemical considerations for oxygen radicalformation and lipid peroxidation. Free Radic Biol Med. 1989;6:289-301.	566
17.	Godina M. Early microsurgical reconstruction of complex trauma of the extremities. Plast Reconstr Surg 1986;78:285-92.	564
18.	Moore FA, Moore EE, Jones TN, McCroskey BL, Peterson VM. TEN versus TPN following major abdominal trauma-reduced septic morbidity. J Trauma 1989;29:916-22.	543
19.	Desborough JP. The stress response to trauma and surgery. Br J Anaesth 2000;85:109-17.	537
20.	Ochoa JB, Udekwu AO, Billiar TR, Curran RD, Cerra FB, Simmons RL, et al. Nitrogen oxide levels in patients after trauma and during sepsis. Ann Surg 1991;214:621-6.	537
21.	MacLeod JB, Lynn M, McKenney MG, Cohn SM, Murtha M. Early coagulopathy predicts mortality in trauma. J Trauma 2003;55:39-44.	535

Appendix 1. The top 100 cited articles in traumatology (continuation)

Rank	Article	Times cited
22.	Holcomb JB, Jenkins D, Rhee P,Johannigman J, Mahoney P, Mehta S,et al.Damage control resuscitation: directly addressing the early coagulopathy of trauma.J Trauma 2007;62:307-10.	532
23.	Hall ED, Braughler JM. Central nervous system trauma and stroke. II. Physiological and pharmacological evidence for involvement of oxygen radicals and lipid peroxidation. Free Radic Biol Med 1989;6:303-13.	530
24.	Corwin JT, Cotanche DA. Regeneration of sensory hair cells after acoustic trauma. Science 1988;240:1772-4.	523
25.	Holcomb JB, Wade CE, Michalek JE, Chisholm GB, Zarzabal LA, Schreiber MA, et al. Increased plasma and platelet to red blood cell ratios improves outcome in 466 massively transfused civilian trauma patients. Ann Surg 2008;248:447-58.	512
26.	Hoffman JR, Mower WR, Wolfson AB, Todd KH, Zucker MI. Validity of a set of clinical criteria to rule out injury to the cervical spine in patients with blunt trauma. National Emergency X-Radiography Utilization Study Group. N Engl J Med 2000;343:94-9.	495
27.	Payne JA, Rivera C, Voipio J, Kaila K. Cation-chloride co-transporters in neuronal communication, development and trauma. Trends Neurosci 2003;26:199-206.	492
28.	Grant AM, Avenell A, Campbell MK, McDonald AM, MacLennan GS, McPherson GC, et al. Oral vitamin D3 and calcium for secondary prevention of low-trauma fractures in elderly people (Randomised Evaluation of Calcium Or vitamin D, RECORD): a randomised placebo-controlled trial. Lancet 2005;365:1621-8.	487
29.	Roumen RM, Hendriks T, van der Ven-Jongekrijg J, Nieuwenhuijzen GA, Sauerwein RW, van der Meer JW, et al. Cytokine patterns in patients after major vascular surgery,hemorrhagic shock, and severe blunttrauma. Relation with subsequent adult respiratory distress syndrome and multiple organ failure. Ann Surg 1993;218:769-76.	484
30.	Kurtz SM, Devine JN. PEEK biomaterials in trauma, orthopedic, and spinal implants. Biomaterials 2007;28:4845-69.	477
31.	Ryals BM, Rubel EW. Hair cell regeneration after acoustic trauma in adult Coturnix quail. Science 1988;240:1774-6.	472
32.	Suter PM, Suter S, Girardin E, Roux-Lombard P, Grau GE, Dayer JM. High bronchoalveolar levels of tumor necrosis factor and its inhibitors, interleukin-1, interferon, and elastase, in patients with adult respiratory distress syndrome after trauma, shock, or sepsis. Am Rev Respir Dis 1992;145:1016-22.	470
33.	Bliuc D, Nguyen ND, Milch VE, Nguyen TV, Eisman JA, Center JR. Mortality risk associated with low-trauma osteoporotic fracture and subsequent fracture in men and women. JAMA 2009;301:513-21.	465
34.	Gentilello LM, Rivara FP, Donovan DM, Jurkovich GJ, Daranciang E, Dunn CW, et al. Alcohol interventions in a trauma center as a means of reducing the risk of injury recurrence. Ann Surg 1999;230:473-80.	465
35.	Smith GC, Pell JP. Parachute use to prevent death and major trauma related to gravitational challenge: systematic review of randomised controlled trials. BMJ 2003;327:1459-61.	456
36.	Boffard KD, Riou B, Warren B, Choong PI, Rizoli S, Rossaint R, et al; NovoSeven Trauma Study Group. Recombinant factor VIIa as adjunctive therapy for bleeding control in severely injured traumapatients: two parallel randomized, placebo-controlled, double-blind clinical trials. J Trauma 2005;59:8-15.	454
37.	Stoutenbeek CP, van Saene HK, Miranda DR, Zandstra DF. The effect of selective decontamination of the digestive tract on colonisation and infection rate in multiple trauma patients. Intensive Care Med 1984;10:185-92.	449
38.	Lowenstein DH, Thomas MJ, Smith DH, McIntosh TK. Selective vulnerability of dentate hilar neurons following traumatic brain injury: a potentialmechanistic link between head trauma and disorders of the hippocampus. J Neurosci 1992;12:4846-53.	448
39.	Geerts WH, Jay RM, Code KI, Chen E, Szalai JP, Saibil EA, et al. A comparison of low-dose heparin with low-molecular-weight heparin as prophylaxis against venous thromboembolism after major trauma. N Engl J Med 1996;335:701-7.	440

Appendix 1. The top 100 cited articles in traumatology (continuation)

Rank	Article	Times cited
40.	Stiell IG, Wells GA, Vandemheen KL, Clement CM, Lesiuk H, De Maio VJ, et al. The Canadian C-spine rule for radiography in alert and stable trauma patients. JAMA 2001;286:1841-8.	429
41.	Trunkey DD. Trauma.Trauma. Accidental and intentional injuries account for more years of life lost in the U.S. than cancer and heart disease. Among the prescribed remedies are improved preventive efforts, speedier surgery and further research. Sci Am 1983; 249:28-35.	428
42.	Jenny C, Hymel KP, Ritzen A, Reinert SE, Hay TC. Analysis of missed cases of abusive head trauma. JAMA 1999;281:621-6.	424
43.	Baker CC, Oppenheimer L, Stephens B, Lewis FR, Trunkey DD. Epidemiology of trauma deaths. Am J Surg 1980;140:144-50.	421
44.	Thomsen IV. Late outcome of very severe blunt head trauma: a 10-15 year second follow-up. J Neurol Neurosurg Psychiatry 1984;47:260-8.	419
45.	Clowes GH Jr, George BC, Villee CA Jr, Saravis CA. Muscle proteolysis induced by a circulating peptide in patients with sepsis or trauma. N Engl J Med 1983;308:545-52.	414
46.	Silverstein BA, Fine LJ, Armstrong TJ. Hand wrist cumulative trauma disorders in industry. Br J Ind Med 1986;43:779-84.	403
47.	Houdijk AP, Rijnsburger ER, Jansen J, Wesdorp RI, Weiss JK, McCamish MA, et al. Randomised trial of glutamine-enriched enteral nutrition on infectiousmorbidity in patients with multiple trauma. Lancet 1998;352:772-6.	396
48.	Hess JR, Brohi K, Dutton RP, Hauser CJ, Holcomb JB, Kluger Y,et al.The coagulopathy of trauma: a review of mechanisms. J Trauma 2008;65:748-54.	391
49.	Kuppermann N, Holmes JF, Dayan PS, Hoyle JD Jr, Atabaki SM, Holubkov R, et al; Pediatric Emergency Care Applied Research Network (PECARN). Identification of children at very low risk of clinically-important brain injuries after head trauma: a prospective cohort study. Lancet 2009;374:1160-70.	388
50.	Fabian TC, Richardson JD, Croce MA, Smith JS Jr, Rodman G Jr, Kearney PA, et al. Prospective study of blunt aortic injury: Multicenter Trial of the American Association for the Surgery of Trauma. J Trauma 1997;42:374-80.	388
51.	Roof RL, Hall ED. Gender differences in acute CNS trauma and stroke: neuroprotective effects of estrogen and progesterone. J Neurotrauma 2000;17:367-88.	383
52.	Kauvar DS, Lefering R, Wade CE. Impact of hemorrhage on trauma outcome: an overview of epidemiology, clinical presentations, and therapeutic considerations. J Trauma 2006;60(6 Suppl):S3-11.	380
53.	Malone DL, Dunne J, Tracy JK, Putnam AT, Scalea TM, Napolitano LM. Blood transfusion, independent of shock severity, is associated with worse outcome in trauma. J Trauma 2003;54:898-905.	377
54.	Moore EE, Jones TN. Benefits of immediate jejunostomy feeding after major abdominal trauma-a prospective, randomized study. J Trauma 1986;26:874-81.	372
55.	Fitch MT, Doller C, Combs CK, Landreth GE, Silver J. Cellular and molecular mechanisms of glial scarring and progressivecavitation: in vivo and in vitro analysis of inflammation-induced secondary injury after CNS trauma. J Neurosci 1999;19:8182-98.	371
56.	Rush BF Jr, Sori AJ, Murphy TF, Smith S, Flanagan JJ Jr, Machiedo GW. Endotoxemia and bacteremia during hemorrhagic shock. The link between trauma and sepsis? Ann Surg 1988;207:549-54.	369
57.	Annegers JF, Grabow JD, Groover RV, Laws ER Jr, Elveback LR, Kurland LT. Seizures after head trauma: a population study. Neurology 1980;30:683-9.	366
58.	Moore FA, Moore EE, Poggetti R, McAnena OJ, Peterson VM, Abernathy CM, et al. Gut bacterial translocation via the portal vein: a clinical perspective with major torso trauma. J Trauma 1991;31:629-36.	363
59.	Unterberg AW, Stover J, Kress B, Kiening KL. Edema and brain trauma. Neuroscience 2004;129:1021-9.	362
60.	Jurkovich GJ, Greiser WB, Luterman A, Curreri PW. Hypothermia in trauma victims: an ominous predictor of survival. J Trauma 1987;27:1019-24.	360

Appendix 1. The top 100 cited articles in traumatology (continuation)

Rank	Article	Times cited
61.	Uzzan B, Cohen R, Nicolas P, Cucherat M, Perret GY. Procalcitonin as a diagnostic test for sepsis in critically ill adults and after surgery or trauma: a systematic review and meta-analysis. Crit Care Med 2006;34:1996-2003.	354
62.	Allakhverdi Z, Comeau MR, Jessup HK, Yoon BR, Brewer A, Chartier S,et al. Thymic stromal lymphopoietin is released by human epithelial cells in response to microbes, trauma, or inflammation and potently activates mast cells. J Exp Med 2007;204:253-8.	348
63.	Roberts GW, Gentleman SM, Lynch A, Graham DI. Beta A4 amyloid protein deposition in brain after head trauma. Lancet. 1991;338:1422-3.	341
64.	Brohi K, Cohen MJ, Ganter MT, Schultz MJ, Levi M, Mackersie RC,et al. Acute coagulopathy of trauma: hypoperfusion induces systemic anticoagulation and hyperfibrinolysis. J Trauma 2008;64:1211-7.	340
65.	Mattiasson G, Shamloo M, Gido G, Mathi K, Tomasevic G, Yi S,et al. Uncoupling protein-2 prevents neuronal death and diminishes brain dysfunction after stroke and brain trauma. Nat Med 2003;9:1062-8.	335
66.	Cosgriff N, Moore EE, Sauaia A, Kenny-Moynihan M, Burch JM, Galloway B. Predicting life-threatening coagulopathy in the massively transfused trauma patient: hypothermia and acidoses revisited. J Trauma 1997;42:857-61.	334
67.	Spahn DR, Bouillon B, Cerny V, Coats TJ, Duranteau J, Fernández-Mondéjar E,et al. Management of bleeding and coagulopathy following major trauma: an updated Europeanguideline. Crit Care 2013;17:R76.	326
68.	Binder LM, Rohling ML, Larrabee GJ. A review of mild head trauma. Part I: Meta-analytic review of neuropsychological studies. J Clin Exp Neuropsychol 1997;19:421-31.	324
69.	Rossaint R, Bouillon B, Cerny V, Coats TJ, Duranteau J, Fernández-Mondéjar E, et al. Crit Care. Management of bleeding following major trauma: an updated European guideline. Crit Care 2010;14(2):R52.	322
70.	Acosta JA, Yang JC, Winchell RJ, Simons RK, Fortlage DA, Hollingsworth-Fridlund P, et al. Lethal injuries and time to death in a level I trauma center. J Am Coll Surg 1998;186:528-33.	312
71.	Martinowitz U, Kenet G, Segal E, Luboshitz J, Lubetsky A, Ingerslev J, et al. Recombinant activated factor VII for adjunctive hemorrhage control in trauma. J Trauma 2001;51:431-8.	304
72.	Border JR, Hassett J, LaDuca J, Seibel R, Steinberg S, Mills B, et al. The gut origin septic states in blunt multiple trauma (ISS=40) in the ICU. Ann Surg 1987 Oct;206(4):427-48.	304
73.	Ledingham IM, Watt I. Influence of sedation on mortality in critically ill multiple trauma patients. Lancet 1983;1:1270.	303
74.	Schöchl H, Nienaber U, Hofer G, Voelckel W, Jambor C, Scharbert G, et al. Goal-directed coagulation management of major trauma patients using thromboelastometry (ROTEM)-guided administration of fibrinogen concentrate and prothrombin complex concentrate. Crit Care 2010;14:R55.	297
75.	Huber-Wagner S, Lefering R, Qvick LM, Körner M, Kay MV, Pfeifer KJ, et al.; Working Group on Polytrauma of the German Trauma Society. Collaborators (4) Seekamp A, Ruchholtz S,Lefering R, Paffrath T. Effect of whole-body CT during trauma resuscitation on survival: a retrospective, multicentre study. Lancet 2009;373:1455-61.	295
76.	Maegele M, Lefering R, Yucel N, Tjardes T, Rixen D, Paffrath T,et al. Early coagulopathy in multiple injury: an analysis from the German Trauma Registry on 8724 patients. Injury 2007;38: 298-304.	291
77.	Rimel RW, Giordani B, Barth JT, Jane JA. Moderate head injury: completing the clinical spectrum of brain trauma. Neurosurgery 1982;11:344-51.	285
78.	Cotanche DA. Regeneration of hair cell stereociliary bundles in the chick cochlea following severe acoustic trauma. Hear Res 1987;30:181-95.	283
79.	Bramlett HM, Dietrich WD. Pathophysiology of cerebral ischemia and brain trauma: similarities and differences. J Cereb Blood Flow Metab 2004;24:133-50.	282

Appendix 1. The top 100 cited articles in traumatology (continuation)

Rank	Article	Times cited
80.	Rogers FB, Cipolle MD, Velmahos G, Rozycki G, Luchette FA. Practice management guidelines for the prevention of venous thromboembolism in trauma patients: the EAST practice management guidelines work group. J Trauma 2002;53:142-64.	282
81.	Konttinen YT, Ainola M, Valleala H, Ma J, Ida H, Mandelin J,et al. Analysis of 16 different matrix metalloproteinases (MMP-1 to MMP-20) in the synovial membrane: different profiles in trauma and rheumatoid arthritis. Ann Rheum Dis 1999;58:691-7.	281
82.	CRASH-2 collaborators (558 researchers), Roberts I, Shakur H, Afolabi A, Brohi K, Coats T, Dewan Y, et al. The importance of early treatment with tranexamic acid in bleeding trauma patients: an exploratory analysis of the CRASH-2 randomised controlled trial. Lancet 2011;377:1096-101,1101.e1-2.	280
83.	Nichols RL, Smith JW, Klein DB, Trunkey DD, Cooper RH, Adinolfi MF,et al. Risk of infection after penetrating abdominal trauma. N Engl J Med 1984;311:1065-70.	278
84.	Nathens AB, Jurkovich GJ, Maier RV, Grossman DC, MacKenzie EJ, Moore M, et al. Relationship between trauma center volume and outcomes. JAMA 2001;285:1164-71.	275
85.	Annegers JF, Grabow JD, Kurland LT, Laws ER Jr. The incidence, causes, and secular trends of head trauma in Olmsted County, Minnesota, 1935-1974. Neurology 1980;30:912-9.	274
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