



Levels of evidence in pelvic trauma: a bibliometric analysis of the top 50 cited papers

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Abstract

Background Scientific research is an essential aspect in the ongoing development of medical education and improved patient care. Dissemination of findings is a pivotal goal of any health research study. The number of citations that a published article receives is reflective of the importance that paper has on clinical practice. To date, it is unknown which journals are most frequently cited as influencing the management of pelvic trauma.

Methods The aim of this study was to identify the top 50 publications relating to the management of pelvic trauma. The database of the Science Citation Index of the Institute for Scientific Information (1945 to 2016) was reviewed to identify the 50 papers most commonly cited.

Results A total of 1535 papers were included. Of these, 31 papers were cited over 100 times with the top 50 cited 69 times or more. The top 50 were subjected to further analysis to identify the authors and institutions involved. The majority of these publications originated in the USA, followed by Canada. The most cited paper is “pelvic ring fractures—should they be fixed”, published by Tile in 1988.

Conclusion We have identified and analysed the publications that have contributed most to the assessment and management of pelvic trauma over the past 50 years. We have also identified the researchers and institutions which have most influenced the evidence-based approach currently employed in the management of pelvic trauma.

Keywords Bibliometric analysis · Levels of evidence · Pelvic trauma

Introduction

Scientific research is an essential aspect of continuing medical education and improving patient care. Dissemination of findings is a pivotal goal in all healthcare research [1, 2]. The number of citations that a published article receives is reflective of its relevance to clinical practice [3]. In addition, individual authors can enhance their specialist reputation by expanding their citation history [3]. The educational contribution of any scientific journal can be measured by assessing the volume of work cited from that journal, and this contribution

is reflected in the impact factor of the journal [4]. Therefore, the importance of publication in peer-reviewed scientific journals cannot be underestimated, both for the individual authors and for the journal itself.

Bibliometrics is defined as a group of methods used to quantify or examine a published body of knowledge [5]. Citation analysis is a commonly used bibliometric method and the prevalence and depth of research can be deduced on its employment based on factors such as geography or emphasis in specific fields of research [6, 7]. The ‘h index’ quantifies the impact of an author who has published ‘h’ papers, each of which has been cited in other papers at least h times [8]. The impact factor of a scientific journal is considered to be the measure of a publication’s influence in its field [9]. It is a measure of the number of citations its published articles have received and is calculated based on the number of citations a journal has obtained in the current year to items published over the previous 2 years, divided by the substantive articles published over the previous 2 years [10–12].

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Dissemination of scientific research is crucial for the ongoing development of the management of pelvic trauma. To our knowledge, bibliometric analysis of published research specific to pelvic trauma has not yet been published. This study is designed to evaluate the worldwide research productivity in the field of pelvic trauma surgery using bibliometric methods and to provide an insight into the pelvic research for surgeons and researchers.

Methods

The database of the Science Citation Index of the Institute for Scientific Information from 1945 to 2016 was reviewed to identify the most frequently cited papers published in the English language (Table 1). We selected the 20 highest impact journals dedicated to trauma and orthopaedic surgery. The top 50 papers were selected for further examination (Table 2) using the technique described by Paladugu et al. [13]. The selected journals were analysed, and the subject of the study, the type of article, authorship, institution, country and the year and decade of publication were recorded. The country of origin was defined by the address provided by the first author. The number of citations considered for inclusion in the top 50 cited papers was with regard to those cited within the published English language literature contained within the science citation index but was not limited to citation only within the abovementioned 20 highest impact journals.

Results

A total of 1535 papers specific to pelvic trauma were identified. Thirty-one papers were cited more than 100 times, and the top 50 papers were cited 42 times or more (Table 1). The top paper was cited 391 times and the 50th paper 69 times (Table 1). The mean number of citations for the top 50 papers was 122.4. The papers were published between 1972 and 2007. The oldest cited paper was by Margolies et al. and was published in 1972 [14]. The newest paper was published in 2007 and written by Cothren et al. [15].

The majority of the papers were published in the 1980s and 1990s, with the 1980s being the decade from which the largest number of highly cited papers was published (32%) (Table 2). The top 50 papers originated from six countries: the USA (40), Canada (4), Egypt (2), Australia (2), Kuwait (1) and Sweden (1) (Table 3). There were 32 institutions responsible for publishing the top cited papers. The top three included University of Louisville, Kentucky, USA; Mayo clinic, Rochester,

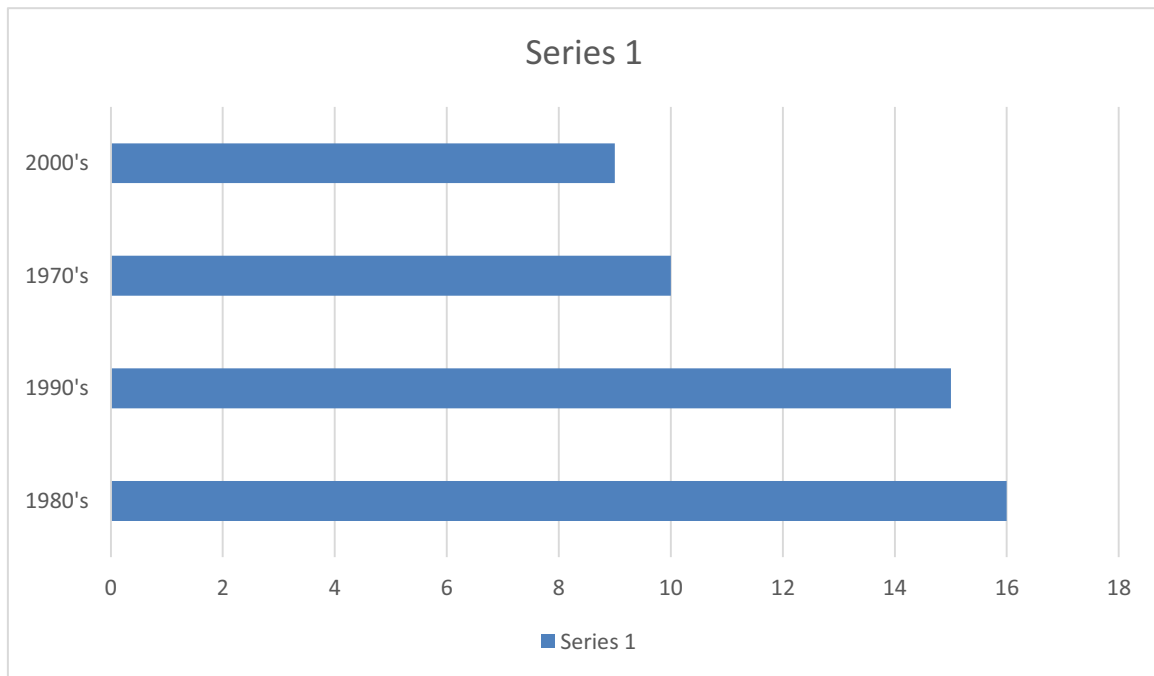
Table 1 Top 50 classic articles on pelvic fractures

Rank	Author	No. of citations
1	Tile, M	391
2	Margolie, MN	220
3	Dalal, SA	204
4	Matta, JM	203
5	Young, JWR	177
6	Rothenberger, DA	170
7	Moreno, C	169
8	Panetta, T	164
9	Ring, EJ	159
10	Agolini, SF	156
11	Gluer, CC	156
12	Kellam, JF	150
13	Benmenachem, Y	148
14	Biffl, WL	147
15	CRYER, HM	138
16	Pohlemann, T	135
17	Eastridge, BJ	132
18	Baxter, NN	129
19	Trunkey, DD	128
20	Danese, MD	122
21	Miller, PR	121
22	Demetriades, D	119
23	Mucha, P	113
24	Huittine, VM	113
25	Koraitim, MM	109
26	Flint, LM	109
27	Gilliland, MD	107
28	Poole, GV	105
29	Cothren, C	104
30	Evers, BM	102
31	Mc Elfres, EC	102
32	Gruen, GS	93
33	Melton, LJ	93
34	Latenser, BA	92
35	Matalon, TSA	92
36	Hak, DJ	84
37	Webster, GD	84
38	Rothenberger, D	81
39	Hubbard, SG	80
40	Majeed, SA	79
41	Mucha, P	79
42	Richardson, JD	78
43	Brenneman, FD	77
44	Mauil, KI	76
45	Koraitim, MM	75
46	Flint, L	75
47	Balogh, Z	71
48	Pereira, S	71
49	Failinger, MS	70
50	Torode, I	69

USA; and University of Kentucky, USA, with four publications each (Table 4).

The 50 papers were published in 18 journals, with 40% of the top 50 papers being published in Journal of Trauma (20), followed distantly by the Annals of Surgery (4), Clinical Orthopaedics and Related Research (3) and the Journal of Urology (3) (Table 6). Only two first named authors (Mamdouh Koraitim and Lewis Flint) within the top 50 published more than one paper (Tables 5 and 6) [16–19].

Table 2 Most popular papers cited by decade



Discussion

This list of citation classics identifies the authors and journals that have made the greatest impact on the practice of pelvic trauma management over the last 70 years. We have identified the papers which have contributed

most significantly to the progression of pelvic trauma management. We have employed the citation count as a proxy measure of research quality which forms a pivotal part of evidence-based medical practice; citations are regarded as a key indicator of the relevance and importance of a published item [20].

Table 3 Countries of origin of most cited papers

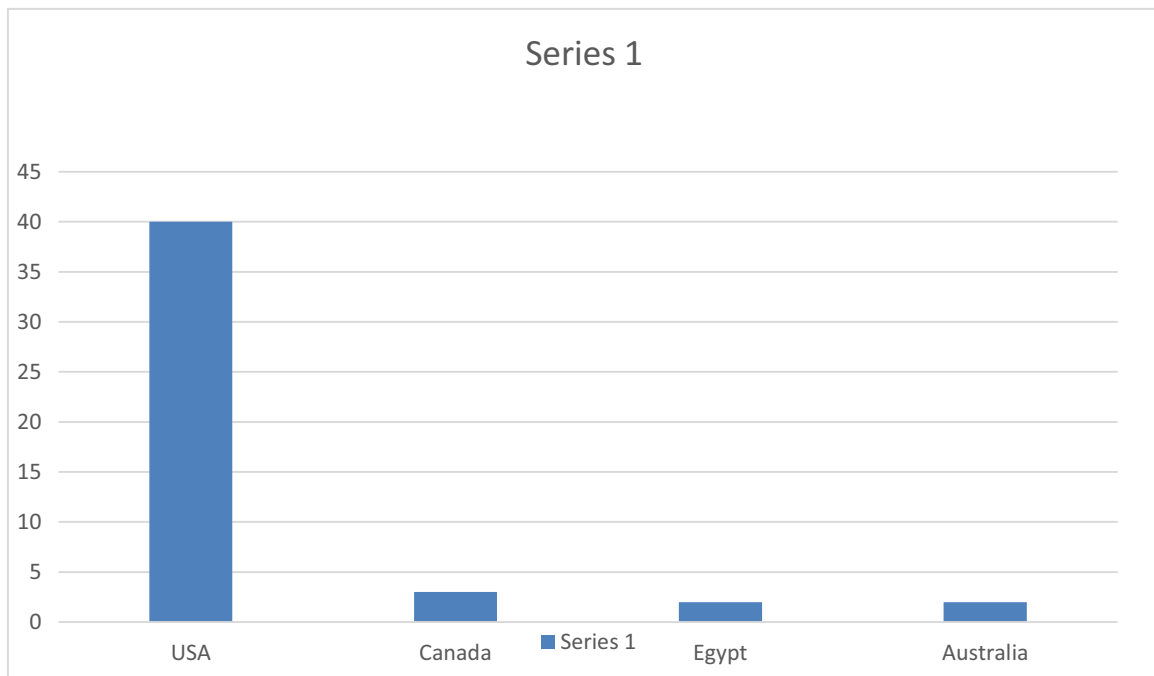


Table 4 Institutions of top cited papers most represented

1	University of Louisville, Kentucky, USA	4
2	Mayo clinic, Rochester, USA	4
3	University of Kentucky, Kentucky, USA	4
4	University of Texas, Texas, USA	3
5	Harvard University, Massachusetts, USA	2
6	Denver health medical centre, Colorado, USA	2
7	University of Maryland, Maryland, USA	2
8	University of California, San Francisco, USA	2
9	University of California, Los Angeles, USA	2
10	University of Toronto, Toronto, Canada	2
11	St. Paul Ramsay Hospital, Minnesota, USA	2
12	University of Alexandria, Egypt.	2

According to the Institute of Scientific Information, the USA has traditionally led the rankings in the output of publications in all 20 scientific disciplines (<http://isithomsonreuters.org/>). Our findings support this assertion. A major finding of this study is that in absolute terms of numbers of articles published within the pelvic trauma literature, the USA is by far the largest contributor. This finding is in agreement with a bibliometric analysis of the classic papers in all aspects of orthopaedics, which found that 77 of the top 100 papers originated in the USA [3].

The majority of papers came from English-speaking countries, with Egypt and Kuwait being the only other representatives. The most extensively cited publication related to whether pelvic ring fractures should be fixed, by Marvin Tile in 1989 [21]. It remains a seminal paper in guiding the management of pelvic fractures, concluding that most pelvic fractures including those that are relatively stable and may be managed by simple techniques. Of the top 50 papers, 32% were published in the 1980s highlighting this period as a time of interest and development in the area of trauma management. Papers such as that published by Tile are referred to time and time again throughout the literature as providing the core framework of pelvic fracture management [21].

Dalal et al. described how the extent of mechanical force, the type and severity of the pelvic fracture give an indicator as to the expected organ injury pattern, resuscitation needs and rate of mortality [22]. While reviewing 343 polytrauma patients, they also noted differences in cause of death with brain injury and shock contributing most in the case of lateral compression injuries in comparison to sepsis, ARDS and shock following anteroposterior compression injuries [22]. In 1986,

Table 5 Authors with more than one of the first cited papers

1.	Koraitim, MM	2
2.	Flint, L	2

Table 6 Journals that published the most cited articles

1.	Journal of trauma- injury, infection, critical care	20
2.	Annals of surgery	4
3.	Clinical orthopaedic and related research	3
4.	Journal of Urology	3
5.	JBJS- (Br)	2
6.	Radiology	2
7.	Surgery	2
8.	American journal of Roentology	2
9.	JBJS (Am)	2
10.	Surgical clinics of North America	2

Young et al. produced a seminal paper using plain radiography and clinical findings to classify pelvic fractures which correlated with associated soft-tissue injury and facilitated timely surgical management. The patterns described were anteroposterior compression, lateral compression, vertical shear and a complex pattern [23].

Inclusion of Cothrens' paper (Preperitoneal pelvic packing for hemodynamically unstable pelvic fractures: A paradigm shift) is remarkable given the context in which it was published in 2007 [15]. The majority of other papers included in the top 50 have four decades of citations, but Cothrens' paper is (at time of writing) less than 20 years old. Its conclusion that pre-peritoneal pelvic packing is a rapid method for controlling pelvic fracture-related haemorrhage that can replace the need for emergent angiography is a mainstay of pelvic management today. It is also interesting to note that the oldest paper included in this analysis by Morgolies et al. describes arteriography as means of controlling haemorrhage associated with pelvic injury [14]. The chronological bookends of our 50 papers therefore describe two different methods for dealing with the same problem [14, 15].

Although there has been a falling trend in the average number of citations per paper since the late-1990s, we are unable to draw a concrete conclusion from this finding. It may be explained by the sharp increase in the number of outputs in the intervening years, or perhaps by the time-lag associated with citation analysis which results in an inherent bias towards older publications. It is possible, and even plausible, that some of the more recent literature may become essential reading in years to come, as progressing time permits future authors to develop citation histories for those papers that are currently new to the literature. Regardless, this analysis has identified the current core set of journals publishing the most relevant research on pelvic trauma and provides a basis for researchers to focus their appraisal of the literature. The top 50 papers were published across 18 different journals, with the Journal of trauma-injury, infection, critical care publishing a remarkable 40% of papers included on the list placing it as the most noteworthy journal in the study of pelvic trauma.

The main limitation of this manuscript is the potential for several types of bias, which may influence results. Consideration must be made for institutional bias, language biases and self-citation. Older journals may receive more citations which is reflected in our findings. It may take a number of years for influential manuscripts to accrue citations due to the publication lead-time for their citing manuscript; therefore, recently published manuscripts that have reached enough citations for inclusion in the top 50 have added importance. A further limitation is the inclusion of only first and senior authors and the institution of the first author as it must be considered that several first authors will have co-authored other papers in the top 50 and are therefore may not be accurately represented in the current study format. We have compiled an overview of the demographics of the most noteworthy publications in pelvic trauma but we have not related our findings to underlying socio-economic and demographic variables. This may be a potential area for further analysis.

Conclusion

Although bibliometric analyses have been conducted across several fields of surgery, we believe this to be the first such study specific to pelvic trauma management. This provides us with detailed information on the necessary characteristics of the top-ranking papers in this area. Our analysis has confirmed the USA to be the forerunner in producing research publications in pelvic trauma surgery. It has documented the history and development of pelvic trauma management and provides useful insights into the institutions and authors who have contributed to this. We have also demonstrated the importance of publishing in the English language and in a journal with a high impact factor. Citation analysis is not a measurement of scientific quality, but it is reflective of the importance that a paper has on clinical practice.

Compliance with ethical standards

No consent was required for this research.

There were no human or animal participants in this study.

Conflict of interest The authors declare that they have no conflict of interest.

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