



Bibliometric and Altmetric Analysis of the 100 Most Cited Articles on Piriformis Syndrome

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Abstract

Aim: A bibliometric analysis is used to quantitatively analyze scientific production and thematic development in a given research area. We aimed to analyze the 100 most cited articles on Piriformis syndrome (PS).

Methods: This observational, descriptive, and retrospective study used a bibliometric technique. Using the word PS the top 100 (T100) most cited articles in the Web of Science between 1975 and 2023 were identified. In the bibliometric analysis, the title, number of authors, author names (first authors and corresponding authors), year and country of publication, number of citations, citation index, genre, subject, Q classification, h-index, impact factor, and publication area were recorded.

Results: The total number of citations in the T100 article list ranged from 7 to 202. Most T100 articles were published between 2001 and 2005 (n=22). The country that produced the most articles was the United States, and the most cited author was Fishman. Clinical studies accounted for the majority of the top 100 articles (n=44). The majority of the T100 articles (n=93) were published in journals with expanded science citation indexes, and the most common field of publication was orthopedics (n=29). The altmetric attention score for the articles ranged from 1 to 435. The altmetric attention score was not available for 54 articles.

Conclusion: The results of this study provide insight into the level of attention that the scientific community and social media platforms pay to the most cited articles in PS. Further research using larger databases to examine interactions across countries is needed.

Keywords: Piriformis syndrome, bibliometric analysis, altmetric analysis, citation

Introduction

The diagnosis of Piriformis syndrome (PS), which causes pain in the lower back, hips, and upper back of the thigh, is not very clear. Compression of the piriformis muscle on the sciatic nerve plays a role in the etiology. Many factors, including trauma and anatomical anomalies, may play a role in the occurrence of PS. PS is diagnosed based on clinical signs and symptoms; as agreed, clinical criteria have yet to be established (1,2). The prevalence of PS is not well known, and it is believed that the syndrome is underdiagnosed. In contrast, there are also

claims of overdiagnosis (3). This may be due to inadequate diagnostic criteria.

Bibliometric analysis is a method used to quantitatively analyze scientific production and thematic development in a particular research field. In any scientific field, citation analysis is a quantitative, bibliometric method that examines the pattern and frequency of citations. Citation analysis is a method for evaluating the influence of particular published works on science and trends in current research. In the scientific field, frequently cited articles present significant new findings. At the same time, these articles demonstrate a growing interest in a

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particular field. In academia, citation analysis is effective for guiding future studies by identifying unstudied areas and introducing novice researchers to the most salient topics in a given field (4-6). When searching for high-quality articles on a particular topic, the criteria usually considered are the journal's impact factor, number of citations, and h-index. Based on the scientific data found in relevant articles, these criteria provide useful information. In addition, social media platforms also play a role in the promotion of medical literature. Thus, altimetric are used to determine the metrics of an article on social media platforms (7,8).

We hypothesized that the most cited articles on PS present diagnostic challenges and new treatment approaches and that they ranked first in terms of the number of citations and altimetric scores. We also hypothesized that most of the most cited articles on PS were published in the United States. In this study, we analyzed the 100 most cited articles (T100) related to PS in the last 30 years and evaluated the relationship between the total number of citations/citation index and the altimetric attention score. Thus, this study aimed to contribute to future studies by identifying popular topics or deficiencies in this field.

Materials and Methods

Study Design and Search Strategy

The Web of Science, accessible at <http://apps.webofknowledge.com>, is a reliable scientific database. In addition to conducting general literature searches, the tool also offers citation index searches, which are useful for assessing the academic significance of an article in a specific field. We performed a PS search of the Web of Science database from 1975 to 2023 on November 28, 2023. The search term used was "Piriformis Syndrome". Articles were organized by sorting based on citation count, with those with higher citation counts placed at the top. The data used in our study were sourced from published articles; therefore, ethics committee approval was not necessary.

Article Selection

Two reviewers (BTD and MO) independently analyzed the abstracts and full texts to identify the 100 (T100) most cited articles on PS. In case of disagreement between the two reviewers, consensus was sought through two other researchers (FB and EA). The examiners were physicians. Articles were included in this study regardless of publication type. Because of the limited number of publications on PS. Articles focusing on PS were included.

Data Extraction

In the bibliometric analysis, the title, number of authors, author names (first authors and corresponding

authors), year and country of publication, number of citations, citation index, genre, subject, Q classification, h-index, impact factor, and publication area were recorded. The article was deemed to be from the country of the responsible author (9). The citation index is calculated as the total number of citations in the article divided by the number of years since the article was published (10). The "Altmetric attention score" was obtained through the "Altmetric it" function on the Altmetric.com website (<https://www.altmetric.com>). The impact of an article is assessed by considering the number of citations as well as the number of views and downloads on social platforms (11,12). The stages of this study are presented in Figure 1.

Statistical Analysis

Statistical analysis was performed using IBM SPSS version 22.0 software (IBM Corp., Armonk, IL, USA). The Kolmogorov-Smirnov/Shapiro-Wilk test was used to determine whether the distribution was normal. For quantitative variables, mean \pm standard deviation values or median [minimum (min.)-maximum (max.)] values are presented when performing descriptive analyses. For categorical variables, frequencies and percentages are provided. The relationships between quantitative variables were assessed using the Spearman or Pearson's correlation tests. An r-value <0.3 indicates a weak relationship, $0.3-0.7$ a moderate relationship, and >0.7 indicates a strong relationship (13). P-values of 0.05 were accepted as statistically significant results.

Results

In this study, articles published between 1975 and 2023 were searched using the Web of Science database by searching the keyword "Piriformis syndrome". T100 articles on PS were published between 1981 and 2021. When the T100 articles were analyzed by year, most articles were published between 2001 and 2005 ($n=22$) and then between 2006 and 2010 ($n=19$) (Figure 2).

T100 articles were published by 21 countries. Almost half of the T100 articles were published in the USA ($n=47$), followed by South Korea ($n=8$). Table 1 shows the countries with ≥ 3 published articles. In total, T100 articles were published in 68 journals. Two or more articles were published in 15 of these journals (Table 2). Most articles were published in Muscle & Nerve ($n=7$) and Archives of Physical Medicine and Rehabilitation ($n=6$). Of the journals that published ≥ 2 articles, 11 were from the United States. 2 were from Germany, one was from France, and 1 was from England (Table 2). The IF (impact factor), Q classification, and H index of the journals publishing ≥ 2 articles are presented in Table 2.

The number of authors for the T100 articles ranged from 1 to 11. Approximately one-third of the T100 articles ($n=32$) were written by ≥ 5 authors. The most

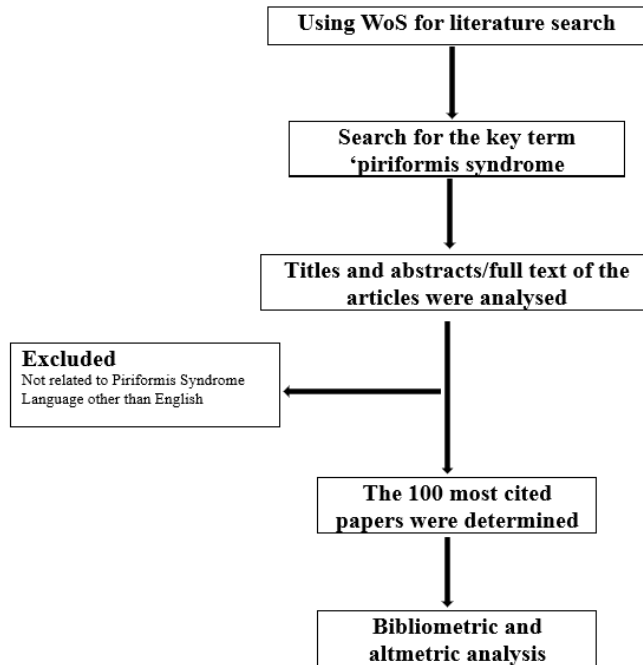


Figure 1. Flowchart of the study
WoS: Web of Science

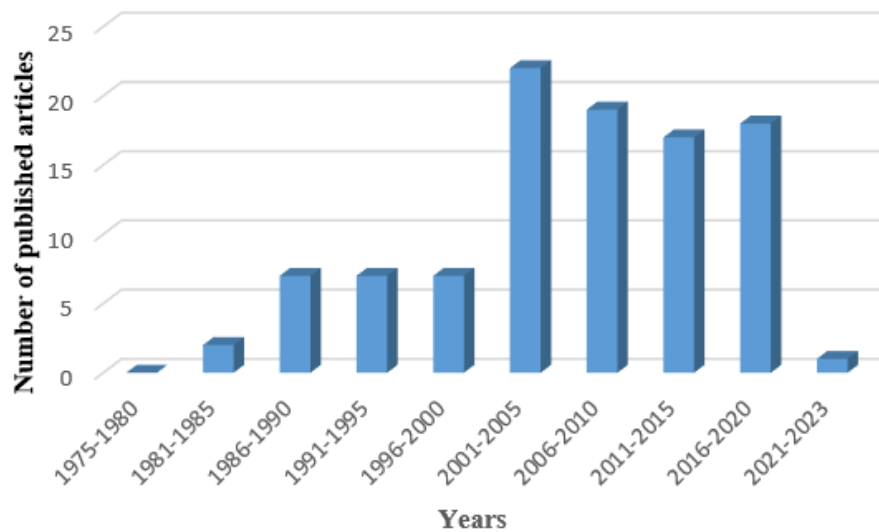


Figure 2. Number of articles published by year

cited author was Fishman LM, who served as the first and corresponding author in 6 articles.

The mean number of citations of the T100 articles was 35.1 ± 32.2 and the median number of citations was 26.5 (min.=7, max.=202). The mean altmetric attention score of the T100 articles was 18.9 ± 64.7 with a median value of 4 (min.=1, max.=435). The altmetric attention score could not be obtained for the 54 articles.

The most cited article in T100 was “Sciatica of Nordic origin and piriformis syndrome: diagnosis by magnetic resonance neurography and interventional magnetic resonance imaging with outcome study of resulting treatment” by Filler et al. (14), published in 1990; this article also had the highest citation index. The article with the highest altmetric attention score was “Diagnosis and Management of Piriformis Syndrome: An Osteopathic

Approach” by Boyajian-O’Neill et al. (15), which was published in 2008. However, this article was ranked 13th in terms of the number of citations.

When T100 articles were analyzed according to their content, publications sharing information about diagnosis and treatment were in the first rank in terms of the number of citations (14,16,17). In terms of the altimetric attention score, a review mentioning the osteopathic approach in the diagnosis and treatment of PS ranked first (15). In PS, when T100 articles were analyzed, the most frequently emphasized topics were treatment (n=57), diagnosis (n=45), etiology (n=22), and symptoms (n=9). There was a moderately significant correlation between the altimetric attention score and the citation index ($p<0.05$, $r=0.312$) (Figure 3). No significant correlation was found between the altimetric attention score and the

total number of citations ($p>0.05$, $r=0.076$) (Table 3). Of the T100 articles, 44 were clinical studies, 5 were clinical guidelines, 29 were case reports, 3 were letters, and 19 were reviews.

The majority of the T100 articles (n=93) were published in journals with expanded science citation indexes. When we looked at the fields in which T100 articles were published, orthopedics (n=29) ranked first, clinical neurology (n=28) ranked second, and surgery (n=22) ranked third (Figure 4).

Discussion

This is the first study to conduct a bibliometric and altimetric analysis of T100 articles on PS. The results of this study reveal advances and areas of interest in PS. Bibliometric analysis quantitatively performs articles published during a given period. Citation analysis is a widely used bibliometric analysis method that identifies highly cited publications. This will help identify advances and areas of interest in the relevant subject. This can shed light on future research. Although citation analysis is a frequently used method to assess article quality, it has some disadvantages (18). It has been reported that the number of citations is affected by many factors, such as the journal in which the article was published (19,20) and the geographical origin of the author (21,22).

As the time elapsed since the article was published increases, the number of citations may increase accordingly (22). However, in this article, we found that most T100

Table 1. Countries where T100 papers were published (n≥3)

Country	Number of articles
US	47
South Korea	8
Canada	6
Italy	5
Japan	5
Germany	3
Spain	3
Turkey	3

Table 2. Journals in which T100 articles have been published (n≥2)

Journal	Number of articles	IF*	Q** Category	H** Index	Country of the journals
Muscle and Nerve	7	3.4	Q2	159	USA
Archives of Physical Medicine and Rehabilitation	6	4.3	Q1	206	USA
American Journal of Physical Medicine & Rehabilitation	4	3.0	Q1	112	USA
European Radiology	4	5.9	Q1	164	Germany
Orthopedics	4	1.1	Q2	73	USA
Journal of Bone and Joint Surgery-American Volume	3	5.3	Q1	290	USA
Surgical and Radiologic Anatomy	3	1.4	Q2	67	France
Journal of Neurosurgical Spine	2	2.8	Q1	113	USA
European Spine Journal	2	2.8	Q1	155	Germany
Journal of the American Osteopathic Association	2	-	-	-	USA
Neurosurgery	2	4.8	Q1	215	USA
Clinical Orthopaedics and Related Research	2	4.2	Q1	225	USA
Regional Anesthesia and Pain Medicine	2	5.1	Q1	119	England
PM&R	2	2.1	Q2	79	USA
Journal of Chiropractic Medicine	2	0.9	Q3	26	USA

*IF: Impact factor, 2022 Journal Citation Reports, Web of Science Group, **2022 SCImago Journal and Country Rank

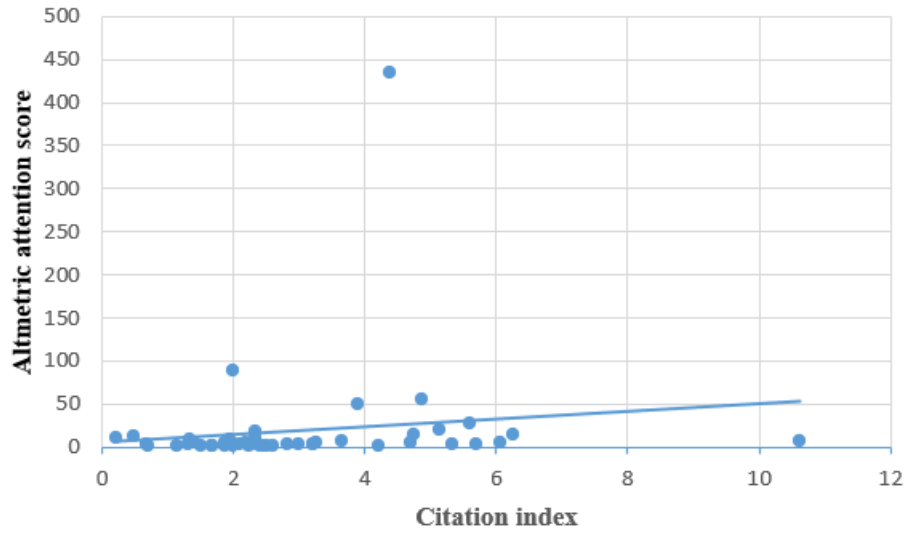


Figure 3. Correlation analysis between the altmetric attention score and citation index

Table 3. Correlation analysis between citation parameters and the altmetric attention score			
		Citation index	Number of citations
Altimetric attention score	r	0.312*	0.076
(Pearson correlation tests) *p<0.05			

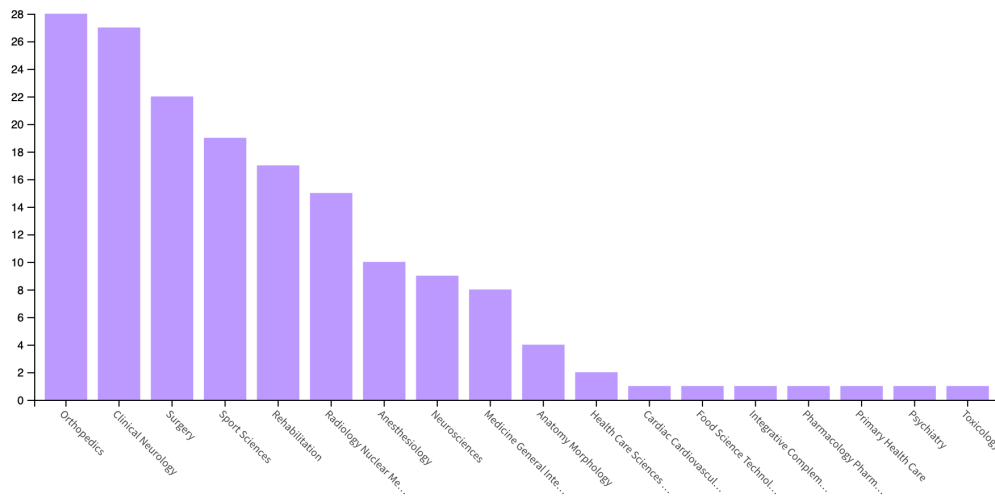


Figure 4. Distribution of articles according to fields in which they are published

articles on PS were published between 2001 and 2005, which may be related to developments in scientific fields. Previously, T100 articles on rheumatoid arthritis and acute kidney injury were published in a similar year range (10,22).

Due to the widespread use of social media in recent years, altmetric analysis can be used as an alternative to the impact factor of citations from web-based journals (23). Altmetric analysis evaluates not only the number of

citations of the article but also the number of downloads, views, and social media value of the articles as an alternative to impact factor and other evaluation methods (12). In this study, altmetric scores could not be obtained for 54 of the articles. This shows that the impact of T100 articles on digital media is insufficient. It is clear that there is a need for more digital discussion on this topic.

The majority (n=47) of T100 articles on PS were published in the United States, as in many other fields.

This result is consistent with our hypothesis. This was followed by South Korea with 7 articles. In the study by Bağcier et al. (11) on fibromyalgia syndrome, Quan et al. (24) on systemic lupus erythematosus, and Goebel et al. (25) on dental fluorosis, T100 articles were mostly published in the United States. This may indicate that scientific quality is high in the United States (11), but a previous study has shown that journals tend to publish articles submitted from their own regions (9). In fact, in this study, the majority of journals that published ≥ 2 articles were from US journals.

The 100 articles with the highest number of citations for PS were identified. Articles were included in this study regardless of publication type. The most cited article in publications about PS had 202 citations. In this study, a total of 29 case reports were found in T100 articles. This shows that authors benefit from case-based articles rather than comprehensive studies during the publication production phase. Therefore, there is undoubtedly a need for high-quality publications in this field. It is evident from previous bibliometric studies that the number of citations of T100 articles is much higher than that of PS (10,11,26,27). This may be due to the fact that PS is not sufficiently recognized, and authors conduct less research on this subject because of insufficient awareness. However, PS has a considerable rate in patients with low back pain, and it has been reported that it constitutes 17.2% of low back pain (28).

Primary PS arising from anatomical variants of nerve and muscle in the etiology of PS corresponds to approximately 15% of all PS cases (29). However, a study included in T100 articles reported that the anatomical variant of the nerve was not associated with PS (30). Although this study was in the last rank according to the number of citations, it was in the second rank according to the altimetric attention score. Secondary PS is more common due to secondary factors, such as trauma (31). PS may develop after trauma to the hip region was mentioned in one article among the T100 articles and ranked fourth according to the number of citations (32).

Since there are no agreed criteria for the diagnosis of PS, diagnosis is based on clinical signs and symptoms (2). The diagnosis of PS has been a subject of curiosity for researchers for years. In fact, the article with the highest number of citations in T100 articles mentioned the diagnosis of PS (14,16). These articles were ranked first in terms of number of citations and citation index. However, they were not ranked first in terms of the altimetric attention score. They secured the 8th and 15th positions, respectively. The article with the highest altimetric attention score also mentioned the diagnosis and

treatment of PS (15). The fact that these articles mention the diagnosis of PS ranked first in terms of the number of citations and altimetric scores supports our hypothesis. Conservative treatment should be attempted first for PS, and local anesthetic and steroid injections may be used if conservative treatment and medical treatment fail. If these treatments fail, surgical methods may be considered (33). The 3 most-cited articles also mentioned local anesthesia and steroid administration for PS. Botulinum toxin, another invasive treatment method, has been shown to reduce pain during PS treatment (34). In fact, botulinum toxin was a popular treatment in T100 articles. In 12 articles, botulinum toxin was mentioned. However, the cost of botulinum toxin is higher than local anesthetics. Botulinum toxin applications should be used in patients who are resistant to first-line treatments (35).

Study Limitations

There are some limitations to this study. First, only the Web of Science database was searched for the articles. Google Scholar, etc., databases were not used. However, one of the most widely used databases for bibliometric analysis is Web of Science (36-39). Second, only articles published in English were analyzed. Third, self-citation was not considered. Fourth, the interaction between countries was not examined. Fifth, such studies usually include articles with long publications (40). Thus, high-quality articles may be overlooked. Sixth, case reports and letters were also included, but the number of articles with ≤ 20 citations was 44. Despite these limitations, this study is the first bibliometric and altimetric analysis of PS, which is an important cause of low back pain and sciatic pain. Thus, it may shed light on future research.

Conclusion

In this study, we analyzed T100 articles on PS according to their level of interest in science and social media. The topics of most interest in PS were treatment and diagnosis. When the number of citations for the T100 articles was analyzed, similar studies in the literature were excluded. This may be due to the low awareness of PS. It is believed that this study will contribute to the design and production of new diagnostic studies. In addition, new studies using languages other than English and from different databases are needed.

Ethics

Ethics Committee Approval: As the data for our study were sourced from published articles, ethics committee approval was not necessary.

Informed Consent: The data used in our study were sourced from published articles.

Footnotes

Authorship Contributions

Concept: B.T.D., F.B., E.A., Design: B.T.D., M.O., Data Collection or Processing: B.T.D., M.O., F.B., Analysis or Interpretation: B.T.D., F.B., E.A., Literature Search: B.T.D., M.O., E.A., Writing: B.T.D., M.O., F.B., E.A.

Conflict of Interest: No conflicts of interest were declared by the authors.

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