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Epidural Steroid Injection: A Bibliometric Analysis of the 100 Most Cited Articles

Epidural Steroid Enjeksiyonu: En Çok Atıf Alan 100 Makalenin Bibliometrik Analizi

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ABSTRACT Objective: Epidural steroid injection (ESI) is frequently used for treating radicular pain. It is especially preferred for pain that persists despite conservative treatment. This study aims to examine the top 100 most cited articles on ESI. **Material and Methods:** The Scopus database was used to search for the 100 most cited articles. The article name, first author, affiliation, name of the journal and year of publication information were examined for the study. In addition, the countries where the cited journals were published, their impact factors, the distribution of the most cited studies by year, and the total number of citations were investigated. **Results:** The 100 most cited studies were selected from 2,784 studies conducted between 1980 and 2024. Most studies were published between 2000 and 2010 and were conducted in the USA (68%). Most publications were found to be published by pain medicine clinics (33%) and were most frequently published in the journal Pain Physician (21%). Publications related to the lumbar region constituted 75% of all publications, and 22 (22%) were associated with ESI complications. **Conclusion:** The present study provides a comprehensive list of the most important articles on ESI from a historical perspective. These data will be helpful to our colleagues who want to study ESI.

Keywords: Citation; epidural; injection; pain; Scopus

ÖZET Amaç: Epidural steroid enjeksiyonu (ESE) radiküler ağrının tedavisinde sıklıkla kullanılır. ESE konservatif tedaviye rağmen devam eden ağrılarda tercih edilir. Bu çalışmanın amacı ise ESE’de en çok atıf alan ilk 100 makaleyi incelemektir. **Gereç ve Yöntemler:** En çok atıf alan 100 makaleyi aramak için Scopus veri tabanı kullanıldı. Makale adı, ilk yazar, yayın yeri, yayın yılı, dergi adı, etki faktörü, en çok atıf alan çalışmaların yıllara göre dağılımı ve atıf sayısı incelendi. **Bulgular:** 1980-2024 yılları arasında yapılan toplam 2.784 araştırma arasından en çok atıf alan 100 araştırma seçildi. Çalışmaların çoğu 2000 ile 2010 yılları arasında yayınlanmış olup ve büyük bir kısmı Amerika Birleşik Devletleri’nde yürütülmüştür (%68). Makalelerin çoğu ağrı klinikleri tarafından yapılmış (%33) ve en sık Pain Physician dergisinde yayınlanmıştır (%21). Lomber bölgeyle ilgili yayınlar tüm yayınların %75’ini oluşturmaktadır ve 22’si (%22) ESE komplikasyonlarıyla ilgilidir. **Sonuç:** Mevcut çalışma, ESE ile ilgili önemli makalelerin tarihsel bir perspektiften kapsamlı bir listesini sunmaktadır. Bu verilerin ESE konusunda çalışma yapmak isteyen meslektaşlarımıza yardımcı olacağını düşünmekteyiz.

Anahtar Kelimeler: Atıf; epidural; enjeksiyon; ağrı; Scopus

Epidural steroid injection (ESI) has been frequently used for treating radicular pain for many years.^{1,2} It is especially preferred for pain that persists despite conservative treatment. Because pain usually occurs due to nerve root compression, ESI aims to

suppress inflammation and relieve pain.² It can be applied to the cervical, thoracic, and lumbar regions. While the transforaminal and interlaminar routes are preferred for all spine regions, the caudal routes can also be performed for the lumbar area. Because low

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back pain is more common in society, it is most commonly performed in the lumbar region. Therefore, ESI increased significantly between 2000 and 2009.³

Synthesizing past research guides new studies and contributes to the advancement of science. Bibliometric analysis is a useful method for mapping publications on a particular topic and is increasingly used in many research areas.⁴⁻⁶ Bibliometric analysis is usually performed by examining the citation history of published articles. The number of citations of an article is a measure of the popularity and readability of the study in that clinical field, and increasing citation numbers contribute to the journal's impact factor.^{4,7} In contrast to the researchers' opinions and subjective data, bibliometric analysis provides quantitative analyses and statistics on that topic. To the best of our knowledge, no bibliometric analysis has been conducted on ESI. For this purpose, we aimed to analyze the 100 most cited studies on ESI and inform our colleagues who will conduct studies on ESI.

MATERIAL AND METHODS

This study was conducted in accordance with the ethical standards specified in the Helsinki Declaration. The Scopus database was used to search for the 100 most cited articles in September 2024. We used the necessary keywords such as "epidural steroid", "epidural corticosteroid", "epidural steroid injection", or "epidural corticosteroid injections" while searching. All studies with the necessary keywords used in the title fields were evaluated by 2 different researchers (RS and GYS). Articles in Scopus (Elsevier, Netherlands) were selected from the top 100 articles using the phrase "highest cited". Articles published between 1980 and September 1, 2024 were scanned and chosen from 2,784 results.

Only human studies were evaluated. The presence of a full text or abstract was not considered an exclusion criterion. The name of the article, the first author, the journal, and the year of publication were examined for the study. In addition, the most cited journals, the countries where the cited journals were published, their impact factors, the distribution of the most cited studies by year, and the total number of

citations that the journals received from these studies were investigated. The affiliations that conducted the studies were also examined. The clinic with the first author was selected for studies conducted by more than one affiliation. In addition, studies related to complications were also examined, as well as the spinal region to which the complication was related.

RESULTS

The 100 most cited studies were selected from 2,784 studies conducted between 1980 and 2024. The most and least cited studies were determined to be 538 and 109, respectively. The 10 most cited studies were published between 1980 and 2014. Only 1 of these 10 studies was related to cervical ESI; the others were associated with the lumbar region. Four of these studies were published in Spine (Table 1).

Paducah. Sixteen (16%) were published by Laxmaiah Manchikanti, who works at this pain center (Figure 1, Figure 2). Most studies were published between 2000 and 2010 (Figure 3). Most studies were conducted in the USA (68%), while the United Kingdom came 2nd with 10 (10%) studies (Figure 4). These studies were published most frequently in the Pain Physician (21%), followed by journals such as Spine and Anesthesia and Analgesia (Table 2). It was determined that most publications were published in pain medicine clinics (33%), followed by anesthesia and rehabilitation clinics (Table 3).

It was seen that 75% of the most cited ESI-related studies were related to the lumbar region. In addition, 22 (22%) studies were related to ESI complications. In complication studies, 9 (41%) studies were related to the cervical region. In addition, 11 (50%), in complication studies (n:22) of the studies were related to transforaminal ESI (Table 4).

DISCUSSION

ESIs have been used for years and are an effective method for treating radicular pain. Since its first use, many studies have been conducted on ESI.^{1,2,8,9} Bibliometric analysis is a valuable method for mapping publications on a particular topic and is increasingly used in many research areas.⁴⁻⁶ The 100 most cited studies on ESI were evaluated in this study. It was

TABLE 1: Titles and general characteristics of the 10 most cited studies

Rank	Title	First author	Year	Source	Cited by
1	Epidural corticosteroid injections for sciatica due to a herniated nucleus pulposus	Carette S.	1997	New England Journal of Medicine	538
2	Transforaminal epidural steroid injections in lumbosacral radiculopathy: A prospective randomized study	Vad Vijay B.	2002	Spine	470
3	Epidural steroids in the management of chronic spinal pain: A systematic review	Abdi S.	2007	Pain Physician	377
4	Efficacy of epidural steroid injections for low-back pain and sciatica: A systematic review of randomized clinical trials	Koes BW.	1995	Pain	373
5	Use of epidural steroids for treating lumbar radicular pain	Cuckler JM.	1985	Journal of Bone and Joint Surgery	341
6	Epidural injections for the diagnosis and treatment of low-back pain	White A.	1980	Spine	311
7	A randomized trial of epidural glucocorticoid injections for spinal stenosis	Friedly JL.	2014	New England Journal of Medicine	294
8	Fluoroscopic transforaminal lumbar epidural steroids: An outcome study	Lutz GE.	1998	Archives of Physical Medicine and Rehabilitation	286
9	A controlled study of caudal epidural injections of triamcinolone plus procaine for managing intractable sciatica	Bush K.	1991	Spine	283
10	Cervical transforaminal epidural steroid injections: More dangerous than we think?	Scanlon G.	2007	Spine	275

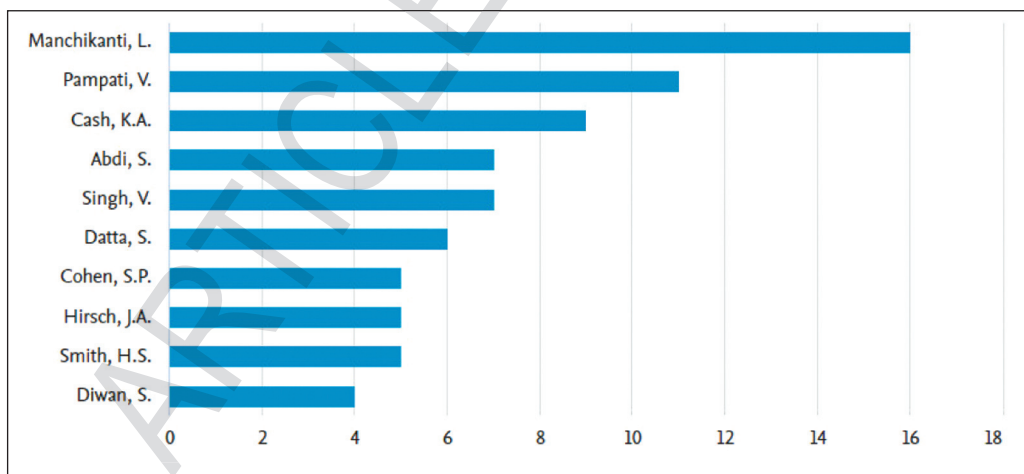


FIGURE 1: Author distribution of the top 100 most cited articles

shown that most of the studies were conducted in the USA between 2000 and 2010 and were published in Pain Physician or Spine journals. The departments where the studies were conducted were mainly pain medicine clinics.

The most cited study on ESI was the study on sciatica by Carette et al. It was published in the New England Journal of Medicine in 1997 and received 538 citations.¹⁰ Similar to this study, most studies were related to the lumbar region. Since low back

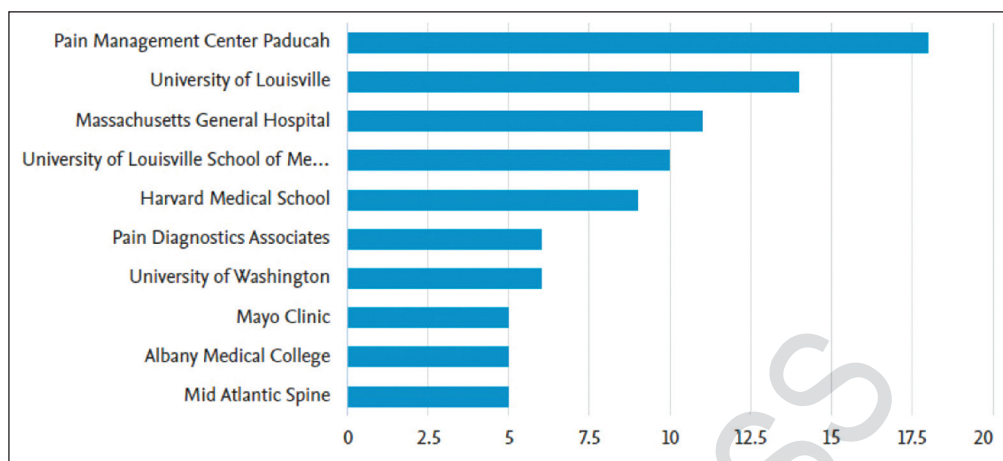


FIGURE 2: Institutional distribution of the top 100 most cited articles

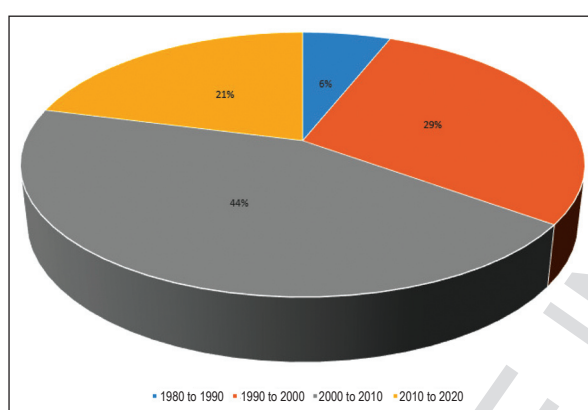


FIGURE 3: Distribution of the top 100 most cited articles by years

pain constitutes a large portion of pain originating from the spine, studies related to this region have been published and cited.¹¹ It was also observed that 37 of the studies were published in the journals Pain Physician and Spine. The small number of journals related to pain and the relatively high impact factors may have directed most of the publications to these journals.

In this study, most articles were published between 2000 and 2010. Manchikanti et al. showed that ESIs increased dramatically between 2000 and 2009 and decreased between 2009 and 2018. The increasing number of ESIs may also have increased the num-

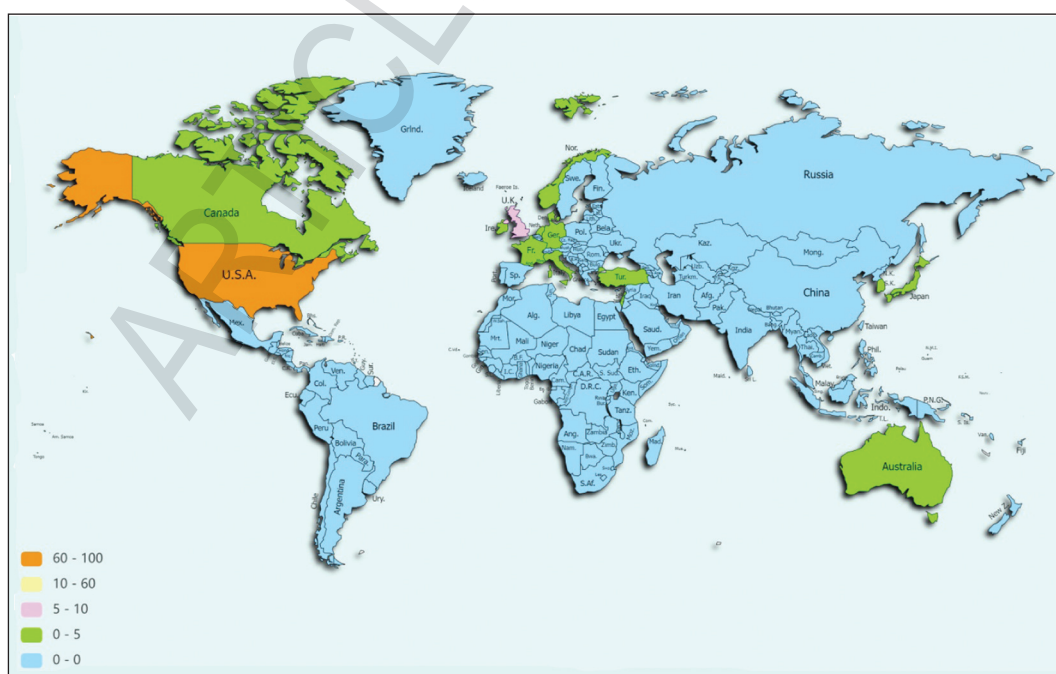


FIGURE 4: Geographic distribution of the top 100 most cited articles

TABLE 2: Journals in which the top 100 most cited articles were published

Journal	Country	Impact factor (2023)	Number of articles	Number of citations
Pain Physician	USA	1.057	21	3427
Spine	USA	1.472	16	3053
Anesthesia and Analgesia	USA	1.761	10	1378
Pain	USA	2.363	6	1302
Rheumatology	England	1.544	4	713
Pain Medicine	England	1.105	3	515
Annals of Internal Medicine	USA	3.804	3	513
Archives of Physical Medicine and Rehabilitation	USA	1.281	3	642
Clinical Journal of Pain	USA	1.131	3	438

TABLE 3: Departments of the articles that produced the top 100 articles

Departments	n
Pain medicine	33
Anesthesia	20
Physical therapy and rehabilitation	19
Orthopedics	9
Radiology	4
Rheumatology	5
Neurology and neurosurgery	3

TABLE 4: General characteristics of the ESI studies

Variable	n (%)
Lumbar ESI	75 (75%)
Cervical ESI	15 (15%)
Complication-related study	22 (22%)
Cervical complication	9 (9%)
Transforaminal complication	11 (11%)

ESI: Epidural steroid injection

ber of studies and citations in this field.³ It was seen that Manchikanti et al. ranked 1st among the 16 most cited studies on ESI. He may have ranked 1st in this study due to his being a researcher with an h-index of 123 and numerous ESI studies.^{8,9,12}

It was determined that most of the studies were conducted by pain specialists, and that studies conducted by anesthesia and rehabilitation physicians were included in the list. It was determined that the most recent publications were published by pain medicine specialists. This may be because pain medicine specialization is becoming more

widespread in the world and is a developing department.¹³ It was also determined that most studies were conducted in the USA. Such a result may have occurred due to the frequent interventional procedures and the number of pain clinics.

There are numerous studies on the complications of ESI.¹⁴⁻¹⁶ In this study, it was seen that most of the studies were about complications related to the cervical region and transforaminal ESI procedures. Major complications, including death, have been reported, especially in cervical procedures.¹⁷⁻¹⁹ Therefore, these types of studies may be of interest. In addition, since transforaminal ESI procedures are performed very frequently and due to the risk of intravascular injection, they may receive a high rate of article citations.^{20,21}

This study has several limitations. First since we only examined the Scopus database, we may have missed some highly cited studies. Furthermore, because we excluded studies from 1980 and before, we may have missed very old studies. We also did not exclude self-citations. However, self-citations have a minor effect.²² Finally, older articles have more citation protection than newer articles.⁷ Despite these limitations, this is the first and most comprehensive study on ESI as a strength.

CONCLUSION

It was seen that most studies on ESI conducted in pain clinics were related to the lumbar region and were published in high-impact factor journals such as Pain Physician or Spine. Our colleagues, who will conduct studies on ESI and want to receive citations, should take this into consideration.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

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