Bibliometric Analysis of the Top 100 Most Cited Articles on Wrist Arthroscopy

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Research article

Keywords: Wrist arthroscopy, TFCC, bibliometric analysis, citation, most cited

Posted Date: April 1st, 2021

DOI: https://doi.org/10.21203/rs.3.rs-367559/v1

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Abstract

**Background:** Over the past few decades, more articles have been published about wrist arthroscopy. The purpose of this study was to identify and analyze the 100 most cited articles about wrist arthroscopy.

**Methods:** The 100 most cited articles were analyzed using the wrist arthroscopy as a keyword on the Web of Science database. Original articles, reviews, clinical trials, and cadaveric studies were included in the study. We recorded and analyzed the following information: Article title, first author, year of publication, journal of publication, the total number of citations, level of evidence, article language, country, institution, and the main topic of study.

**Results:** The number of citations ranged from 35 to 180 (mean, 64.74). The total number of citations was 6,474. Among the articles examined, the most prolific country was the United States of America (USA). The Journal of Hand Surgery - American Volume was the journal with the most number of publications and the most cited articles. The main topics that were most analyzed and underlined were the diagnostic comparison of Magnetic resonanas imaging and arthroscopy and the diagnosis and treatment of triangular fibrocartilage complex.

**Conclusions:** As a result, wrist arthroscopy continues to develop, and it is a subject that is open for new studies. More comprehensive and up-to-date randomised controlled studies comparing the benefit of wrist arthroscopy or open surgery for wrist pathologies will demonstrate the importance of arthroscopy in the diagnosis and treatment of problems related to this topic.

**Introduction**

At the current age, where the limits of computer and internet technologies are challenged, the virtual environment is gradually becoming the main source for researchers to access information. Nonetheless, easy access to the information leads to an increase in incorrect and incomplete information. Hence, academic portals that provide quality information at international standards have become of great importance. Citation analysis helps us make a decision about the quality of an academic publication [1, 2]. In the orthopedic literature, there are different studies involving citation analyses on various topics [3–6]. There is no study involving citation analysis about wrist arthroscopy in the literature. In general, there is one previous publication that scanned all cases of wrist arthroscopy [7]. With the widespread use of arthroscopic procedures involving narrow joints, wrist arthroscopy has been used in the diagnosis and treatment of wrist diseases for 30 years; and its importance is gradually increasing [8, 9]. Wrist arthroscopy is frequently used for diagnosis and simultaneous treatment in triangular fibrocartilage complex (TFCC), ganglion cysts of the wrist, distal radial and carpal bone fractures, intercarpal ligament injuries [10–12].

This study aims to perform a bibliometric analysis on the 100 most cited articles about the diagnosis and treatment of wrist arthroscopy.
Methods

The Web of Science Core Collection is recognized as the most suitable online database for bibliometric analysis. The search was performed using the term wrist arthroscopy in the search bar under the title category or the topic category on January 2021 including all articles from 1990 to 2020 using the Web of Science platform. After search the database, all articles were ranked from the most cited to the least cited. Articles not related to the diagnosis and treatment process of wrist arthroscopy were excluded. We recorded and analyzed the following information: article title, first author, year of publication, journal of publication, total number of citations, level of evidence, article language, country, institution, and main topic of study.

Results

A total of 790 publications related to wrist arthroscopy were identified. The 100 highest cited papers according to number of citations can be seen in Table 1. The number of citations ranged from 35 to 180 (average, 64.74). The total number of citations was 6,474. Of the 100 articles, 37 (37%) were published between 1990 and 2000, 52 (52%) were published between 2000 and 2010, and only 11 (11%) were published between 2010 and 2020. The year with the highest total number of citations was 2012 (499) Table 2. Among the articles, 96 were written in English, and 4 were written in German.
# Table 1
List of the top 100 cites articles on wrist arthroscopy with citations

| Rank | Article                                                                 | Total citations |
|------|-------------------------------------------------------------------------|-----------------|
| 1    | Triangular fibrocartilage tears                                         | 180             |
| 2    | Peripheral tears of the triangular fibrocartilage complex cause distal radioulnar joint instability after distal radial fractures | 140             |
| 3    | Chronic wrist pain: spin-echo and short tau inversion recovery MR imaging and conventional and MR arthrography | 135             |
| 4    | Magnetic resonance imaging and miniarthroscopy of metacarpophalangeal joints - Sensitive detection of morphologic changes in rheumatoid arthritis | 119             |
| 5    | The unar fovea sign for defining ulnar wrist pain: An analysis of sensitivity and specificity | 116             |
| 6    | Comparison of synovial tissues from the knee joints and the small joints of rheumatoid arthritis patients - Implications for pathogenesis and evaluation of treatment | 113             |
| 7    | Scapholunate ligament reconstruction using a bone-retinaculum-bone autograft | 111             |
| 8    | Epidemiology of musculoskeletal upper extremity ambulatory surgery in the United States | 107             |
| 9    | Sport injuries: a review of outcomes                                     | 106             |
| 10   | Wrist ligament tears: Evaluation of MRI and combined MDCT and MR arthrography | 101             |
| 11   | Alefacept treatment in psoriatic arthritis - Reduction of the effector T cell population in peripheral blood and synovial tissue is associated with improvement of clinical signs of arthritis | 101             |
| 12   | The utility of high-resolution magnetic resonance imaging in the evaluation of the triangular fibrocartilage complex of the wrist | 100             |
| 13   | Comparison of 3-T MRI and Arthroscopy of Intrinsic Wrist Ligament and TFCC Tears | 98              |
| 14   | Arthroscopic repair of triangular fibrocartilage complex tears           | 95              |
| 15   | Distal radioulnar instability is an independent worsening factor in distal radial fractures | 90              |
| 16   | The ulnocarpal stress test in the diagnosis of ulnar-sided wrist pain    | 90              |
| 17   | Isolated tears of the triangular fibrocartilage: Management by early arthroscopic repair | 89              |
| 18   | Evaluation of chronic wrist pain by arthrography, arthroscopy, and arthrotomy | 89              |
| 19   | Ulnar shortening for triangular fibrocartilage complex tears associated with ulnar positive variance | 88              |
| Rank | Article                                                                 | Total citations |
|------|-------------------------------------------------------------------------|-----------------|
| 20   | Arthroscopic resection of dorsal ganglion of the wrist                   | 82              |
| 21   | The scapholunate interosseous ligament in MR arthrography of the wrist:  | 81              |
|      | Correlation with non-enhanced MRI and wrist arthroscopy                  |                 |
| 22   | Comparison of the findings of triple-injection cinearthrography of the wrist with those of arthroscopy | 81              |
| 23   | MR imaging diagnosis of triangular fibrocartilage pathology with arthroscopic correlation | 79              |
| 24   | Limitations of MR Imaging in the diagnosis of peripheral tears of the triangular fibrocartilage of the wrist | 78              |
| 25   | Prevalence of musculoskeletal disorders at the NFL combine-trends from 1987 to 2000 | 77              |
| 26   | Magnetic resonance imaging of the wrist: Diagnostic performance statistics | 77              |
| 27   | Diagnostic comparison of 1.5 Tesla and 3.0 Tesla preoperative MRI of the wrist in patients with ulnar-sided wrist pain | 76              |
| 28   | Evaluation of the triangular fibrocartilage complex tears by arthroscopy, arthrography, and magnetic-resonance-imaging | 75              |
| 29   | Treatment of intra-articular fractures of the distal radius - Fluoroscopic or arthroscopic reduction? | 74              |
| 30   | Intercarpal ligament injuries associated with fractures of the distal part of the radius | 74              |
| 31   | The carpal ligaments in MR arthrography of the wrist: Correlation with standard MRI and wrist arthroscopy | 74              |
| 32   | A comparison of combined arthroscopic triangular fibrocartilage complex debridement and arthroscopic wafer distal ulna resection versus arthroscopic triangular fibrocartilage complex debridement and ulnar shortening osteotomy for ulnocarpal abutment syndrome | 72              |
| 33   | Internal derangement of the wrist: Indirect MR arthrography versus unenhanced MR imaging | 72              |
| 34   | New trends in arthroscopic management of type 1-B TFCC injuries with DRUJ instability | 70              |
| 35   | Ulnar impaction syndrome: MR imaging findings                            | 70              |
| 36   | Clinical comparison of arthroscopic versus open repair of triangular fibrocartilage complex tears | 69              |
| 37   | Results of acute arthroscopically repaired triangular fibrocartilage complex injuries associated with intra-articular distal radius fractures | 68              |
| 38   | Ulna-shortening osteotomy after failed arthroscopic debridement of the triangular fibrocartilage complex | 68              |
| Rank | Article                                                                 | Total citations |
|------|-------------------------------------------------------------------------|-----------------|
| 39   | Mr-imaging of anatomy and tears of wrist ligaments                        | 67              |
| 40   | Arthroscopic reduction versus fluoroscopic reduction in the management of intra-articular distal radius fractures | 64              |
| 41   | Direct MR arthrography of the wrist in comparison with arthroscopy: A prospective study on 125 patients | 62              |
| 42   | Intra-articular distal radius fractures: Arthroscopic assessment of radiographically assisted reduction | 61              |
| 43   | Lesions of the triangular fibrocartilage complex: MR findings with a three-dimensional gradient-recalled-echo sequence | 61              |
| 44   | Foveal TFCC Tear Classification and Treatment                             | 60              |
| 45   | Partial scapholunate ligament injuries treated with arthroscopic debridement and thermal shrinkage | 59              |
| 46   | Blatt's capsulodesis for chronic scapholunate dissociation                | 59              |
| 47   | Interosseous ligament tears of the wrist: Comparison of multi-detector row CT arthrography and MR imaging | 58              |
| 48   | Arthroscopic repair of the triangular fibrocartilage complex              | 56              |
| 49   | Peripheral tear of the triangular fibrocartilage: Depiction with MR arthrography of the distal radioulnar joint | 55              |
| 50   | New advances in wrist arthroscopy                                         | 54              |
| 51   | Dry arthroscopy of the wrist: Surgical technique                          | 54              |
| 52   | Complications of wrist arthroscopy                                        | 54              |
| 53   | Extrinsic carpal ligaments: Normal MR arthrographic appearance in cadavers | 54              |
| 54   | Applied anatomy of the superficial branch of the radial nerve             | 53              |
| 55   | The role of arthroscopy in the treatment of intraarticular wrist fractures | 53              |
| 56   | Arthroscopic versus open dorsal ganglion excision: A prospective, Randomized comparison of rates of recurrence and of residual pain | 52              |
| 57   | Current concepts in wrist arthroscopy                                     | 52              |
| 58   | Comparison between high-resolution MRI with a microscopy coil and arthroscopy in triangular fibrocartilage complex injury | 52              |
| 59   | Wrist arthroscopy for the treatment of ligament and triangular fibrocartilage complex injuries | 52              |
| 60   | Arthroscopically assisted reduction of intraarticular distal radial fractures | 52              |
| 61   | The radial sensory nerve - an anatomic study                              | 52              |
| Rank | Article                                                                 | Total citations |
|------| ------------------------------------------------------------------------|-----------------|
| 62   | Mr evaluation of triangular fibrocartilage complex tears in the wrist - comparison with arthrography and arthroscopy | 52              |
| 63   | Prospective Outcomes and Associations of Wrist Ganglion Cysts Resected Arthroscopically | 51              |
| 64   | 3.0 T high-resolution MR imaging of carpal ligaments and TFCC          | 51              |
| 65   | Results of repair of peripheral tears in the triangular fibrocartilage complex using an arthroscopic suture technique | 51              |
| 66   | Wrist arthrography versus arthroscopy: A comparative study of 150 cases | 51              |
| 67   | Comparison of Arthroscopic and Open Treatment of Septic Arthritis of the Wrist | 49              |
| 68   | A comparison of the findings of wrist arthroscopy and magnetic resonance imaging in the investigation of wrist pain | 49              |
| 69   | A comparison of magnetic resonance imaging and arthroscopy in the investigation of chronic wrist pain | 49              |
| 70   | Arthroscopic management of wrist triangular fibrocartilage complex injuries in the athlete | 49              |
| 71   | Intrinsic ligament and triangular fibrocartilage complex (TFCC) tears of the wrist: comparison of isovolumetric 3D-THRIVE sequence MR arthrography and conventional MR image at 3 T | 48              |
| 72   | Arthroscopy-assisted fracture fixation                                   | 48              |
| 73   | Wrist arthroscopy - indications and results                              | 48              |
| 74   | Intrinsic ligament and triangular fibrocartilage complex tears of the wrist: comparison of MDCT arthrography, conventional 3-T MRI, and MR arthrography | 47              |
| 75   | Arthroscopic resection in the management of dorsal wrist ganglions: Results with a minimum 2-year follow-up period | 47              |
| 76   | Arthroscopic portals of the wrist - an anatomic study                    | 46              |
| 77   | The application of indirect reduction techniques in the distal radius: The role of adjuvant arthroscopy | 45              |
| 78   | Press test for office diagnosis of triangular fibrocartilage complex tears of the wrist | 45              |
| 79   | A comparison of CT arthrography of the wrist to findings during wrist arthroscopy | 44              |
| 80   | Chronic lunotriquetral instability – diagnosis and treatment            | 44              |
| 81   | MRI in the diagnosis of cartilage injury in the wrist                   | 43              |
| 82   | Percutaneous fixation of scaphoid fractures                              | 43              |
| Rank | Article                                                                                                                                                                                                                  | Total citations |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| 83   | Treatment of isolated injuries of the lunotriquetral ligament - A comparison of arthrodesis, ligament reconstruction and ligament repair                                                                                 | 43              |
| 84   | The effect of observer experience on magnetic resonance imaging interpretation and localization of triangular fibrocartilage complex lesions                         | 43              |
| 85   | Wrist ligament injuries: value of post-arthrography computed tomography                                                                                                                                                    | 42              |
| 86   | Diagnostic accuracy of plain radiographs and cineradiography in diagnosing traumatic scapholunate dissociation                                                                                                         | 40              |
| 87   | Association between extrinsic and intrinsic carpal ligament injuries at MR arthrography and carpal instability at radiography: Initial observations                                                                  | 40              |
| 88   | Early isolated triangular fibrocartilage complex tears: Management by arthroscopic repair                                                                                                                                  | 40              |
| 89   | Diagnostic usefulness of synovial vascular morphology in chronic arthritis. A systematic survey of 100 cases                                                                                                              | 39              |
| 90   | Arthroscopically Assisted Repair of Triangular Fibrocartilage Complex Foveal Tears                                                                                                                                       | 38              |
| 91   | The Natural Course of Traumatic Triangular Fibrocartilage Complex Tears in Distal Radial Fractures: A 13–15 Year Follow-up of Arthroscopically Diagnosed but Untreated Injuries                                             | 38              |
| 92   | Arthroscopic Treatment of Peripheral Triangular Fibrocartilage Complex Tears With the Deep Fibers Intact                                                                                                                  | 38              |
| 93   | Arthroscopic Treatment of Triangular Fibrocartilage Wrist Injuries in the Athlete                                                                                                                                          | 38              |
| 94   | Standard wrist arthroscopy. Technique and documentation                                                                                                                                                                   | 37              |
| 95   | Arthroscopically Assisted Reattachment of Avulsed Triangular Fibrocartilage Complex to the Fovea of the Ulnar Head                                                                                                       | 37              |
| 96   | Triangular fibrocartilage injuries in pediatric and adolescent patients                                                                                                                                                 | 37              |
| 97   | Instability of the Distal Radioulnar Joint - an Overview of Clinical and Radiological Procedures Regarding their Efficacies                                                                                                | 36              |
| 98   | Arthroscopic Resection of Dorsal Wrist Ganglia: 114 Cases With Minimum Follow-Up of 2 Years                                                                                                                                | 36              |
| 99   | High-resolution MR imaging of triangular fibrocartilage complex (TFCC): comparison of microscopy coils and a conventional small surface coil                                                                                | 36              |
| 100  | MRI versus arthroscopy in the diagnosis of scapholunate ligament injury                                                                                                                                                 | 35              |

Table 2.
All articles were published in 28 different journals, with the Journal of Hand Surgery-American volume contributing the most 28 (28%), followed by Arthroscopy: Journal of Arthroscopic and Related Surgery 13 (13%), Radiology 7 (7), American Journal of Roentgenology 6 (6), Journal of Hand Surgery-British and European volume 5 (5%), Skeletal Radiology 5 (5%), The Journal of Bone and Joint Surgery (American Volume) 4 (4%), Hand Clinics 4 (4%), Clinical Orthopedics and Related Research 3 (3%), Arthritis and Rheumatism 3 (3%), The Journal of Bone and Joint Surgery (British Volume) 2 (2%), RoFo-Fortschritte auf dem Gebiet der Rontgenstrahlen und der Bildgebenden Verfahren 2 (2%), Handchirurgie Mikrochirurgie Plastische Cirurgie 1 (1%), Operative Orthopädie und Traumatologie 1 (1%), Seminars in Arthritis and Rheumatism 1 (1%), American Journal of Sports Medicine 1 (1%), Clinical Radiology 1 (1%), Annals of Plastic Surgery 1 (1%), The Journal of Trauma Injury Infection and Critical Care 1 (1%), Knee Surgery, Sports Traumatology, Arthroscopy 1 (1%), Journal of Magnetic Resonance Imaging 1 (1%), Magnetic Resonance Imaging 1 (1%), Orthopedics 1 (1%), Scandinavian Journal of Plastic and Reconstructive Surgery and Hand Surgery 1 (1%), Journal of Computer Assisted Tomography 1 (1%), Clinical Anatomy 1 (1%), Radiographics 1 (1%), Medicine and Science in Sports Exercise 1 (1%), British Medical Bulletin 1 (1%), BMC Musculoskeletal Disorders 1 (1%), respectively.

According to the origins of the journals where the articles were published, there were 44 articles about orthopedics, 26 articles about radiology and nuclear medicine, 14 articles about sports science, 7 articles about surgery, and 4 articles about rheumatology. The remaining 5 articles were about emergency medicine, general internal medicine, anatomy and morphology, critical care medicine, and rehabilitation, respectively.

The most prolific years were 2001 with 9 articles published, followed by the years 2007 and 2008 with 8 articles published in each. There were articles from 18 different countries and 71 different institutes. The most productive institutes were Mayo Clinic from the United States of America (USA) with 8 publications; Wake Forest University, Yale University, and Brown University from the USA with 4 publications each (Table 3). In terms of country and region of origin, most articles were from the United States of America.
(51), which was followed by Germany (9), the United Kingdom (6), Japan (6), Switzerland (5), and Italy (4) (Table 4).

| Institution                                      | Record Count |
|--------------------------------------------------|--------------|
| Mayo clinic                                      | 8            |
| Wake Forest University                          | 4            |
| Brown University                                | 4            |
| Yale University                                 | 4            |
| Chinese University of Hong Kong                 | 3            |
| Nagoya University                               | 3            |
| Lund University                                 | 3            |
| Heinrich-Heine University of Dusseldorf          | 2            |
| University of Amsterdam                         | 2            |
| Hospital for Special Surgery, New York           | 2            |
| Hokkaido University                             | 2            |
| University of Pennsylvania                      | 2            |
| University of Modena                            | 2            |
| Balgrist University Hospital                    | 2            |
| Others                                           | 57           |

Table 3
Top contributing Institutions

Table 4.
The most cited article was the article by Cooney WP et al. published in the Journal of Hand Surgery-American Edition with 180 citations [13]. The most-cited author was Cooney, WP, who had published 2 articles (2%). The total number of citations associated with Cooney WP was 269. The topic of the most cited article included the diagnosis and treatment of TFCC (13).

Among the 100 most cited articles, 86 were identified as original articles, 6 were review articles, 7 were cadaveric studies and 1 was a clinical trial. Based on the criteria on level of evidence, 5 articles were providing Level I evidence, 14 articles providing level II evidence, 36 articles providing level III evidence, 36 articles providing level IV evidence, and 9 articles providing level V evidence.

Among the 100 most cited articles, the 5 most discussed main topics were as follows: 1) The use of Magnetic resonanas imaging (MRI), arthroscopy, and arthrography in the diagnosis of the wrist – 33 (33%), 2) The diagnosis and treatment of TFCC injuries – 24 (24%), 3) Arthroscopic intercarpal ligament repair – 11 (11%), 4) Arthroscopy-assisted fracture fixation – 10 ( 10%), and 5) Arthroscopic excision of the ganglion cysts on the wrist – 6 (6%).

Discussion

Wrist arthroscopy has been of increasing importance in the arthroscopy branch of orthopedics since the day it was first defined. New techniques have constantly been defined, and new treatment procedures are created [14]. In the present study, our aim was to analyze the most cited articles in this developing field and to create a basic resource for the orthopedics community.

In the present study, we performed a bibliometric analysis on the articles about wrist arthroscopy, which were published between 1990 and 2020 [15, 16]. The earliest article was published by Cerofolini E. et al.
in 1990 [17]. The highest number of publications were made between 2000 and 2010. The interest in arthroscopy increased with the first publication in, leading to an increase in the need for research on wrist arthroscopy. Accordingly, the number of publications also increased.

Looking at the articles analyzed, the most studied topic was the diagnostic value and comparison of MRI and arthroscopy in wrist pathologies. Other most discussed topics were interventional procedures such as the treatment of TFCC injuries, intercarpal ligament repair, and fracture fixation. Of the articles, 44 (44%) were published in the journals of orthopedics, and 26 (26%) were published in the journals of radiology. These results indicate that the basic studies on the wrist are diagnostic, and there is an increasing trend in the use of interventional procedures in wrist arthroscopy. When we looked up the articles concerning comparing the benefit of wrist arthroscopy over either open surgery or non operative management of wrist pathology, arthroscopy is superior to open surgery especially in TFCC repair, intercarpal ligament repair and diagnosis and treatment of joint surface pathologies.

As demonstrated in our results, the USA was the country where most articles were published, similar to the majority of previous bibliometric analyses[18–20]. The limited contribution from Africa, South America, and Australia may be due to the fact that their current publications are not listed in this database, or are not highly cited. The institute, where the highest number of studies were conducted, was Mayo Clinic. When all results are examined, it was observed that there were contributions to this subject from 71 different institutes in 18 different countries. This result indicates that wrist arthroscopy is a popular field of interest worldwide, which requires further research.

The most cited article was the original article titled 'Triangular Fibrocartilage Tears' by Cooney WP et al., which was published in the Journal of Hand Surgery-American Edition, with 180 citations[13]. The Journal of Hand Surgery-American Edition was the journal with the highest number of citations, and the journal that published the highest number of articles. The underlying reason for this high scientific contribution may be having a higher gross national product, receiving more research support, and having more senior researchers in the USA [16].

Our study has several limitations. First of all, the number of citations alone cannot determine the importance of an article. We may have excluded many quality studies from the analysis due to the low number of citations. Only published articles were included in the study while meeting records, textbooks, academic presentations, and lectures were excluded. We only searched the Web of Science database; we did not search the Pubmed, Medline, or Embase databases. Nonetheless, we believe that Web of Science is more reliable compared to the other databases in terms of content, quality, and transparency. We observe that the most cited articles are the articles with old dates. On the other hand, since the number of citations of newly published articles will be determined over time, they cannot be analyzed at this time. This may have caused us to exclude many high-quality articles in the study.

Conclusions
The present study will shed light on the developmental stages of wrist arthroscopy over a 30-year period. In conclusion, wrist arthroscopy is a subject that is open to improvement among the wrist pathologies in terms of both diagnosis and treatment, and it requires further research. This study reports the basic information about published articles on wrist arthroscopy and so is of particular relevance to a practicing surgeon and will help with decision making related to the treatment of wrist pathology by arthroscopy of otherwise. Further randomised controlled studies concerning arthroscopic or open surgery for this subject to be conducted on the wrist joint would provide easier and more applicable solutions about the pathologies of this region.

Abbreviations

TFCC: Triangular fibrocartilage complex; Magnetic resonance imaging: MRI; United States of America: USA

Declarations

Authors’ contributions

NG and VK drafted the manuscript and revised it critically for important intellectual content. NG analyzed and interpreted the data. NG and VK contributed substantially to the conception and design of the study. All authors read and approved the final manuscript.

Authors’ information

Not applicable

Funding

The authors received no financial support for the research, authorship, and/or publication of this article

Availability of data and materials

Data requests are available from the corresponding author

Etchical approval

The study does not need institutional review board. The study does not contain any human or animal parts.

Consent for publication

Not applicable.

Declaration of conflicting interests
The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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