An Analysis of the Mutual Publications of Anatomists and Otorhinolaryngologists: A Bibliometric Study based on the Web of Science Database

Ahmet Mahmut Tekin¹, İlhan Bahşi²

¹Klinikum Bad Salzungen, Department of Otorhinolaryngology, Bad Salzungen, Germany
²Gaziantep University, Faculty of Medicine, Department of Anatomy, Gaziantep, Turkey

ORCID ID: A.M.T. 0000-0003-1604-3382; İ.B. 0000-0001-8078-7074

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ABSTRACT

Objective: The aim of this study is to bibliometrically examine the mutual studies in the fields of anatomy and otorhinolaryngology (ORL) recorded in the Web of Science (WoS) database between 1980-2020.

Material and Methods: The mutual publications of anatomists and otolaryngologists on 31.01.2021 are listed in the Science Citation Index-Expanded category of the Advanced Search section of the WoS database. Thus, in the search field tags, Department of Anatomy for anatomists and Department of Ear, Nose, and Throat (ENT) or Department of Otorhinolaryngology or Clinic of ENT or Clinic of Otorhinolaryngology for otolaryngologists were used for the address section. Publications from 2021, meeting abstracts, proceedings papers, early accesses, and book chapters were excluded. After the exclusion criteria were applied, the bibliometric characteristics of the remaining publications were examined.

Results: After the exclusion criteria were applied, 1395 articles were found. The total number of citations made to these articles was 42537, and at least one citation was made to 1279 of the 1395 articles (91.68%). The h-index of these articles was 82, and the average number of citations was 30.49. In these articles, the most frequently used first five keywords were immunohistochemistry (44 times), rat (39 times), cochlea (38 times), anatomy (36 times), and facial nerve (27 times).

Conclusion: The results of our bibliometric study which evaluated the last 40 years of data in terms of networks, collaborations, and institutions could be an inspiration and source for future researchers. We may state that with the increasing technology, the applicability of interventional methods in the field of ORL might be increased by conducting more anatomical studies and yield safer results.

Keywords: Anatomy, otorhinolaryngology, article, bibliometric analysis

INTRODUCTION

Anatomy is one of the oldest fields of medicine that examines the organs that make up the body and the functionality between these organs (1, 2). In this long process, the mysteries of the human body have become more understandable thanks to anatomical dissections (1). Especially with the development of high-resolution imaging methods in the last half-century, radiological and clinical studies have been added to anatomic cadaver studies (3). Continuously increasing technological developments have also increased the capacity of medical imaging techniques and have enabled a more detailed and accurate understanding of anatomical structures (4). In this way, the functions and anatomy of these structures and the relationship between them can be investigated in more detail, and solutions are sought for complex clinical situations (5). Thanks to many anatomical studies in the field of otorhinolaryngology (ORL), a more detailed understanding of the structures has been provided, the relationship of these structures with clinical situations can be evaluated, and even the surgical methods to be applied can be planned (6-9).

Many researchers need to collaborate in medical publications, unlike in other fields (10). This is because co-authorship is essential in the emergence of publications in the medical field (11). Bibliometric analysis is gaining in importance and evaluates existing research data accurately and efficiently on an evidence-based basis (12, 13). Bibliometric analysis is a
compelling method for predicting the change and evolution of a research field (11, 13). It can also provide evidence for a better understanding of the developmental trend in a particular area (14, 15). Bibliometry evaluates the productivity of countries and institutes, as well as objective analysis such as a change in research topics (15, 16).

The Web of Science (WoS) database is one of the most popular databases used in bibliometric research today (13, 17). One of the most critical criteria of international productivity is the number of articles in the WoS database and the number of citations made to these articles. Since this criterion is seen as an indicator of quality, it can be widely used in the evaluation of countries, institutions, and academicians (17).

As a result of the detailed literature review, it was seen that although there have been separate bibliometric studies conducted in the field of anatomy (5, 11), and ORL (18), no bibliometric study evaluating the joint publications of both fields was found.

The aim of this study is to bibliometrically examine the joint studies in the fields of anatomy and ORL recorded in the WoS database between 1980-2020.

**MATERIAL AND METHODS**

The mutual publications of anatomists and otolaryngologists on 31.01.2021 are listed in the Advanced Search section of the WoS database. Thus, in the search field tags, Department of Anatomy for anatomists and Department of Ear, Nose, and Throat (ENT) or Department of Otorhinolaryngology or Clinic of ENT or Clinic of Otorhinolaryngology for otolaryngologists were used for the address section [AD= (Dept ENT* OR Dept Otorhinolaryngol* OR ENT Clin* OR Otorhinolaryngol Clin*) AND AD= (Dept Anat*)].

Firstly, in the index section of the WoS, the Science Citation Index-Expanded (SCI-E) category was selected. Later, publications from 2021, meeting abstracts, proceedings papers, early accesses, and book chapters were excluded. After the exclusion criteria were applied, bibliometric characteristics of the determined publications, such as the distribution of the country and institutes, distribution of keywords, the journals they were published in, number of articles, and number of citations, were examined. VOSviewer (Visualizing scientific landscapes) software was used for the detailed analysis of bibliometric data (12).

**RESULTS**

As of 31.01.2021, the number of articles published mutually by anatomists and otorhinolaryngologists between 1980-2020 in SCI-E indexed journals in the WoS database was determined as 1596. After the exclusion criteria was applied, 1395 articles were found. The distribution of these articles by year is given in Figure 1. It was determined that the number of citations made to these articles was 42537, and the distribution of citations by years is given in Figure 2. It was determined that at least one citation was made to 1279 of 1395 (91.68%) articles. The h-index of these articles was 82, and the average number of citations was 30.49.

The top 25 countries with the most articles are shown in Table 1. The first five of these countries were Japan (n: 303, 21.72%), the USA (n: 301, 21.58%), Germany (n: 223, 15.99%), South Korea (n: 178, 12.76%), and Turkey (n: 127, 9.10%), (since studies with authors from more than one country were not excluded in this distribution, the total value was more than 100%).

The number of publications from the top 20 most productive institutes is shown in Table 2. The top 5 ranks were Yongsei University (n: 81, 5.81%), Umea University (n: 72, 5.16%), the
Table 1: The number of mutual publications of anatomists and otorhinolaryngologists of the top 25 countries.

| Country            | Number of publications | Percent |
|--------------------|------------------------|---------|
| Japan              | 303                    | 21.720  |
| USA                | 301                    | 21.577  |
| Germany            | 223                    | 15.986  |
| South Korea        | 178                    | 12.760  |
| Turkey             | 127                    | 9.104   |
| Sweden             | 114                    | 8.172   |
| Peoples R China    | 94                     | 6.738   |
| Netherlands        | 80                     | 5.735   |
| France             | 77                     | 5.520   |
| Australia          | 75                     | 5.376   |
| Belgium            | 73                     | 5.233   |
| England            | 70                     | 5.018   |
| Italy              | 68                     | 4.875   |
| Spain              | 68                     | 4.875   |
| Canada             | 60                     | 4.301   |
| Finland            | 57                     | 4.086   |
| India              | 55                     | 3.943   |
| Austria            | 53                     | 3.799   |
| Greece             | 50                     | 3.584   |
| Norway             | 41                     | 2.939   |
| Switzerland        | 41                     | 2.939   |
| Brazil             | 39                     | 2.796   |
| Romania            | 37                     | 2.652   |
| Iran               | 34                     | 2.437   |
| Portugal           | 33                     | 2.366   |

Table 2: The number of mutual publications of anatomists and otorhinolaryngologists of the top 20 institutes.

| Institute                                      | Number of publications | Percent |
|------------------------------------------------|------------------------|---------|
| Yonsei University                             | 81                     | 5.806   |
| Umea University                               | 72                     | 5.161   |
| University of California System                | 67                     | 4.803   |
| University of Cologne                         | 61                     | 4.373   |
| Kyushu University                             | 48                     | 3.441   |
| Chinese University of Hong Kong                | 45                     | 3.226   |
| Karolinska Institutet                         | 41                     | 2.939   |
| Kyung Hee University                          | 41                     | 2.939   |
| Seoul National University                     | 40                     | 2.867   |
| University of Helsinki                        | 39                     | 2.796   |
| University of Oslo                            | 36                     | 2.581   |
| Johns Hopkins University                      | 35                     | 2.509   |
| National Institutes of Health                  | 35                     | 2.509   |
| University of Western Australia               | 35                     | 2.509   |
| University System of Maryland                 | 35                     | 2.509   |
| Friedrich Schiller University of Jena          | 34                     | 2.437   |
| Harvard University                            | 33                     | 2.366   |
| State University System of Florida             | 33                     | 2.366   |
| University of Barcelona                       | 33                     | 2.366   |
| University of Maryland Baltimore               | 32                     | 2.294   |
The University of California System (n: 67, 4.80%), the University of Cologne (n: 61, 4.37%) and Kyushu University (n: 48, 3.44%).

The top 25 journals with the most articles are shown in Table 3. The first five of these journals were Acta Oto Laryngolologica (n: 78, 5.59%), European Archives of Oto Rhino Laryngology (n: 56, 4.01%), Laryngoscope (n: 36, 2.58%), Hearing Research (n: 35, 2.50%), and Journal of Laryngology and Otology (n: 28, 2.00%).

By using VOSviewer software, the distribution of the top 20 most used keywords in the examined articles were visualized and can be seen in Figure 3. The first five keywords are immunohistochemistry (44 times), rat (39 times), cochlea (38 times), anatomy (36 times), and facial nerve (27 times). By using VOSviewer software, it was determined that there was a significant change in the use of keywords between 2006-2012 (Figure 4).

By using VOSviewer software, the distribution of the top 50 most used words in the abstract of these articles were visualized and are shown in Figure 5. It was determined that there was a significant change in the use of these words between 2007-2012 (Figure 6).

**DISCUSSION**

Scientific publications are generally accepted as the objective parameters of the scientific success of any institution or researcher, as well as being accepted as a way to share new medical information and current clinical practices with a wide audience (19). The productivity of countries, institutions, and international cooperation in a particular field of research can be evaluated using the bibliometric method of analysis (20).

In the present study, Japan and the USA were found to be the two leading countries with regard to the number of co-produced articles in the field of anatomy and ORL. In a study which compared the articles published in 11 journals with the

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### Table 3: The number of mutual publications of anatomists and ototorhinolaryngologists of the top 25 journals.

| Journal                                           | Number of publications | Percent |
|---------------------------------------------------|------------------------|---------|
| Acta Oto Laryngologica                            | 78                     | 5.59%   |
| European Archives of Oto Rhino Laryngology        | 56                     | 4.01%   |
| Laryngoscope                                      | 36                     | 2.58%   |
| Hearing Research                                  | 35                     | 2.50%   |
| Journal of Laryngology And Otology                | 28                     | 2.00%   |
| Annals of Otology Rhinology And Laryngology       | 23                     | 1.64%   |
| Surgical And Radiologic Anatomy                   | 23                     | 1.64%   |
| Brain Research                                    | 21                     | 1.50%   |
| Annals of Anatomy Anatomischer Anzeiger            | 18                     | 1.29%   |
| International Journal of Pediatric Ototorhinolaryngology | 16                   | 1.14%   |
| Neuroscience Letters                              | 15                     | 1.07%   |
| Auris Nasus Larynx                                | 14                     | 1.00%   |
| Clinical Anatomy                                  | 14                     | 1.00%   |
| Otolarinology Head And Neck Surgery               | 14                     | 1.00%   |
| Otology Neurotology                               | 14                     | 1.00%   |
| Plos One                                          | 14                     | 1.00%   |
| Journal of Neuroscience                           | 13                     | 0.93%   |
| Romanian Journal of Morphology And Embryology     | 13                     | 0.93%   |
| Cell And Tissue Research                          | 12                     | 0.86%   |
| Lancet                                            | 12                     | 0.86%   |
| Neuroscience                                      | 12                     | 0.86%   |
| Journal of Craniofacial Surgery                   | 11                     | 0.78%   |
| Experimental Neurology                            | 10                     | 0.71%   |
| Scientific Reports                                | 10                     | 0.71%   |
| American Journal of Rhinology Allergy             | 9                      | 0.64%   |
Figure 4: Network visualization map for trends based on keyword analysis on analysis of mutual publications of anatomists and otorhinolaryngologists from 1980–2020 (indicator shows current publications from blue to yellow).

Figure 5: Network visualization map for cluster analysis based on abstract analysis on analysis of mutual publications of anatomists and otorhinolaryngologists from 1980–2020 (the size of the circle indicates a large number of publications; thick lines indicate strong relationship and colors indicate cluster idem).
highest impact factor between 2009 and 2013, Japan stood out as the country with the highest growth curve (18). The increase seen in the USA for the production of articles may be associated with greater research funds being awarded. More specifically, the National Health Institutes in USA are reported to have received awards of 30 billion dollars for medical research in 2014 (21). In developing countries, including Africa, some researchers make studies on their own or independently instead of collaborating with developed countries (22). This may be one of the reasons why developing countries produce fewer articles as compared to the other parts of the world. Also, in our study, there are no African countries among the first leading 25 countries. We consider that this problem may be solved through bringing international collaboration resources and the researchers in developing countries together. When the mutual articles in the field of anatomy and ORL were analyzed with regard to distribution according to universities, about one-third of the first leading 20 universities were seen to be located in the USA. This performance may be associated with national and international collaborations that could affect the visibility of the research and frequency of citations (23) alongside the availability of economic power, support funds, and research opportunities (24, 25). In addition, in a bibliometric analysis evaluating university-industry relationships in the USA, it was emphasized that universities had high-quality research environments that have strong research bonds (26). In conclusion, it is seen that many qualified articles can be produced when a trained workforce and sufficient financial and technological support come together. Identifying the universities where co-published articles in anatomy and ORL are produced will guide young researchers interested in the subject in terms of future research environments.

The journals that are active in a certain research field may be identified by detecting the distribution of the articles related to that subject and the researchers may select journals accordingly (20). Callaham et al. (27) reported that an article published in a journal with a low impact factor attracts less attention than it deserves, and an article published in a journal with a high impact factor attracts more attention than it deserves. From this point of view, bibliometric analysis can help find active journals in the field of research, guiding researchers to get their articles more accepted.

The keywords in an article indicate the relevant points in the related article (28). These points not only represent those key elements but also the potential trends of future research (29). As authors use prominent points as keywords in their articles, it is important to easily scan the frequency and distribution of keywords in the article using bibliometric analysis to highlight the important points of the topic. In co-published articles in the field of ORL and anatomy, the three most common keywords are “cochlea”, “facial nerve” and “inner ear” in the field of otology. In an anatomy study conducted in the field of a cochlear implant, the significant increase in cochlear implant procedures in recent years has led to the need for a detailed and accurate understanding of the anatomy of the inner ear not only from the point of view of experimental scientists but also from the point of view of otorhinolaryngologists.
Furthermore, together with the integration of robotic techniques in cochlear implant surgery in recent years (31), many anatomical cadaver studies have been conducted which evaluated facial nerves and the other anatomic structures in the inner ear and indicated the feasibility of robotic technology (32-35). In terms of determining the boundaries of future research areas, this study shows that any technological development integrated into interventional treatment, such as in robotic cochlear implant surgery, can be supported by anatomical studies.

As part of medical education, it was emphasized that teamwork skills should be developed, and researchers should work with different disciplines where the responsibilities of health care workers are shared, and abilities overlap (36). It has been stated that anatomy studies are part of medical education along with other disciplines in cadaver studies related to the human body (37). The present study, which evaluated co-published articles in the field of anatomy and ORL over the past 40 years, shows that research between different disciplines on the subject is gradually increasing and suggests that there will be more in the future. We consider that this study might guide young researchers who plan to study in the field of anatomy and ORL in terms of ideas and foresight.

Our analyses are based on the articles reported in SCI-E in the WoS database over the last 40 years. While data analysis is relatively objective and comprehensive, it has some limitations specific to bibliometric methodology. Databases other than the WoS, for example, Scopus, Pubmed, and Google Scholar were not included since many databases could not be technically joined. Moreover, the language of WoS is English, although it is a global tool. As a result, several articles might be overlooked as articles published in other languages are not included. Finally, the database is still open, and the research can continuously be updated. Over time, these data should be updated by comparing with the results in different databases.

CONCLUSION

Bibliometric analysis is an extremely useful tool for determining global publication trends in peer-reviewed journals and its importance is gradually increasing. Herein, we evaluated 1395 articles co-published in anatomy and ORL between 1980 and 2020 in terms of countries, institutes, journals, and keywords used. The results of our bibliometric study evaluating the last 40 years in terms of networks, collaborations, and institutions could be an inspiration and source for future researchers. We can state that with advances in technology, the applicability of interventional methods in the field of ORL might be increased by conducting more anatomical studies and yield safer results.

Ethics Committee Approval: Ethics committee approval was not received due to the nature of this study.

Informed Consent: Informed consent was not obtained due to the nature of the study.

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