Tiroidektomi Yayınlarının Global Sonuçlarının İncelenmesi: 1980 ve 2020 Arasında Bibliyometrik Bir Analiz

Investigation of Thyroidectomy Publications: A Bibliometric Analysis between 1980 and 2020

Celil Uğurlu[1], Mustafa Sami Bostan[1]

[1]Tokat Gaziosmanpasa Univesity Faculty of Medicine, Department of General Surgery, Tokat

Corresponding Author:

Celil UĞURLU

Tokat Gaziosmanpaşa Üniversitesi Tıp Fakültesi, Genel Cerrahi Anabilim Dalı, Tokat

E-mail:
basri_celil@hotmail.com

Özet

Amaç: Tiroidektomi, genel cerrahi işlemler arasında en sık yapılan ameliyatlardan biridir. Ancak literatürde bu konuda kapsamlı bir bibliyometrik çalışma bulunmamaktadır. Çalışmanın amacı, 1980-2020 yılları arasında tiroidektomi ile ilgili yapılan bilimsel çalışmaların çıktılarını bibliyometrik ve istatistiksel analizlerle değerlendirmek, en etkili çalışmaları belirlemek, güncel konuları ve uluslararası işbirliklerini ortaya koymaktır.

Yöntemler

Literatür taraması Web of Science (WoS) veri tabanı kullanılarak yapıldı. WoS veri tabanı, yayınların "başlık" bölümlerine "tiroidektomi" ve "tiroid cerrahisi" anahtar kelimeleri girilerek tarandı ve bulunan makaleler bibliyometrik olarak analiz edildi. Korelasyon analizlerinde Spearman korelasyon katsayısı kullanılmış ve gelecek yıllardaki yayın sayısını tahmin etmek için lineer regresyon analizi yapılmıştır.

Sonuçlar

Toplam 6650 yayın bulundu. Bu yayınların 4692 makalesi (%70,5) bibliyometrik olarak analiz edildi. Makalelerin çoğunluğu Cerrahi (2402, %51.2), Kulak Burun Boğaz (735, %15.7) ve Endokrinoloji Metabolizması (553, %11.8) alanlarındaydı. Literatüre katkıda bulunan ilk 5 ülke ABD (1004, %21,3), Güney Kore (528, %11.2), İtalya (483, %10,2), Çin (406, %8,6) ve Türkiye (302, %6,4) oldu.). En aktif üç kurum Yonsei Üniversitesi (100), Kore Üniversitesi (82) ve Seul Ulusal Üniversitesi (79) idi. En yüksek yayın kaydına sahip ilk 2 dergi World Journal of Surgery (%240, %5,1) ve Surgery (172, %3,7) idi.

Tartışma

Tiroidektomi ile ilgili bu kapsamlı bibliyometrik çalışma, bilim adamları ve klinisyenler için faydalı bir rehber olacaktır.

Anahtar Kelimeler: Thyroidectomy; thyroid surgery; bibliometric analysis; trend topics

Background

Thyroidectomy is one of the most commonly performed operations among general surgical procedures. However, the literature has no comprehensive bibliometric study on this topic. The aim of the study was to evaluate the outputs of scientific studies on thyroidectomy that were performed between 1980 and 2020, through bibliometric and statistical analyses, to determine the most effective studies, and to reveal current issues and international collaborations.

Methods

The literature review was performed using the Web of Science (WoS) database. The WoS database was searched by entering the keywords “thyroidectomy” and "thyroid surgery" in the “title” sections of publications, and the articles found were analyzed bibliometrically. The Spearman correlation coefficient was used in the correlation analyses, and a linear regression analysis was made to estimate the number of publications in future years.

Results

A total of 6650 publications was found.4692 articles (70.5%) of these publications were analyzed bibliometrically. The majority of the articles were in the field of Surgery (2402, 51.2%), Otorhinolaryngology (735, 15.7%), and Endocrinology Metabolism (553, 11.8%). The top 5 countries contributing to the literature were the USA (1004, 21.3%), South Korea (528, 11.2%), Italy (483, 10.2%), China (406, 8.6%), and Turkey (302, 6.4%). The most active three institutions were Yonsei University (100), Korea University (82), and Seoul National University (79). The top 2 journals with the highest publication records were the World Journal of Surgery (240, 5.1%), and Surgery (172, 3.7%).

Conclusion

This comprehensive bibliometric study on thyroidectomy will be a useful guide for scientists and clinicians.

Keywords: Thyroidectomy; thyroid surgery; bibliometric analysis; trend topics

Introduction

Thyroidectomy is an operation that involves the surgical removal of the thyroid gland, either wholly or partially (1). Thyroidectomy is one of the most commonly performed operations among general surgical procedures. After the 2015 ATA guidelines, hemithyroidectomy is considered appropriate for thyroid tumors between 1 and 4 cm, while total thyroidectomy is recommended for nodules over 4 cm or extrathyroidal spread and metastasis (2). In suspected lymph nodes, the malignancy should be confirmed by ultrasound-guided fine-needle aspiration biopsy (2). Although the incidence of post-thyroidectomy complications is low, some complications such as postoperative hypoparathyroidism, postoperative hypocalcemia, recurrent laryngeal nerve injury, superior laryngeal nerve injury, infection, airway injury and bleeding are reported. The extent of surgery and the experience level of the surgeon play an important role in surgical complications (3). A multi-centered study by Rosato et al. (2004) with 14.934 patients who undergo surgery in 5 years in Italy reported that the exact overall complication rate was 7.1%. They reported that 1.7% of the patients experienced permanent hypoparathyroidism, 8.3% transient hypoparathyroidism (symptomatic hypocalcemia) (63% of all complications), as well as 3.4% of the patients had laryngeal recurrent nerve lesions (1.0% had permanent recurrent laryngeal nerve paralysis, 2.0% temporary paralysis and 0.4% diplegia). They also reported that the superior laryngeal nerve was injured in 3.7% of the patients; 1.4% of the cases had dysphagia, 1.2% bleeding and 0.3% wound infection. All these complications were observed more

frequently in patients operated on for tumors and lymph node dissection added to surgery (4).

Thyroid nodules are frequently seen clinical cases. Also, differentiated thyroid cancer has become more widespread recently [3]. Differentiated thyroid cancer (DTC), including papillary (85%) and follicular (10%) cancers could be counted as a significant part of thyroid cancers (<90%) (5). The incidence of thyroid cancer every year varies with respect to geographical location, age and gender. According to the guideline published for adult patients having thyroid nodules and DTC, epidemiologic studies revealed the prevalence of palpable thyroid nodules was nearly 5% in females and 1% in males living in iodine-sufficient zones. Worldwide, the incidence rates are very high in some specific regions, such as Hawaii with the figures of 119/million females and 45/million males due to local environmental influences, while the figures in Poland are among the lowest rates with the figures of 14 per million females and 4 per million males (6). The review of the National Cancer Database in the USA covering 14 years (between 2000 and 2013) have revealed that cases of thyroid cancer increased from 7.1 per 100,000 in 2000 to 17.6 per 100,000 in 2013 (7).

Bibliometrics is the statistical analysis of scientific publications, especially articles (8-12). Bibliometric analyses give much information such as the trend topics on which most studies have been performed, the most cited important studies, the activities of institutions, authors and countries, and the collaboration between them (13-14). Bibliometric studies that provide a summary of the literature can reduce to time spent for the literature review as well as provide researchers with new study ideas by revealing previous and current trends on the topic (15-16). In recent years, many important bibliometric studies have been performed in the literature of medicine (8-189.

Despite of many advancements in the diagnosis and treatment of both thyroid nodules and DTC in the last 20 years, clinical debates on many topics are still ongoing. Although thyroid disease is an important disease that is common in society and affects the quality of life of patients, the literature has still no bibliometric study on thyroidectomy, which is the most preferred treatment option. This study aimed to provide holistic and brief information about thyroidectomy based on the evaluation of scientific studies on thyroidectomy that were published between 1980 and 2020, through bibliometric and statistical analyses. For this purpose, the most effective studies, trend topics, international collaborations, active journals, institutions, authors and countries regarding thyroidectomy were determined. The aim of this study is to guide clinicians who are considering publishing on thyroidectomy by determining popular publications and journals in this field.

Methods

The literature review was performed using the Web of Science (WoS) database. The WoS database was searched using the keywords “thyroidectomy” and "thyroid surgery" ("thyroid surgeries", "thyroid cancer surgery", "thyroid carcinoma surgery", "thyroid nodule surgery", "thyroid gland surgery", "thyroid malignancy surgery") and the search was made only in the “title” sections of publications. The publications published between 1980 and 2020 were downloaded

from the WoS (date of access: 1.12.2020) and analyzed bibliometrically. The codes for researchers to access similar documents: (*title: (thyroidectomy) or title: ("thyroid surgery") or title: ("thyroid surgeries") or title: ("thyroid cancer surgery") or title: ("thyroid carcinoma surgery") or title: ("thyroid nodule surgery") or title: ("thyroid gland surgery") or title: ("thyroid malignancy surgery") Timespan: All years. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI.)* The statistical analysis was performed using SPSS (Version 22.0, SPSS Inc., Chicago, IL, USA) software program. The conformity of the data with normal distribution was evaluated by the Shapiro-Wilk test. The linear regression analysis was performed to estimate the number of publications in future years. A difference with $P<0.05$ was considered statistically significant. VOSviewer (Version 1.6.15) software program was used for bibliometric network visualizations [19]. The world map was plotted using (*https://app.datawrapper.de*) website.

Results

As a result of the literature review, a total of 6650 publications on thyroidectomy that were published between 1980 and 2020 were found. Of these publications, 4692 (70.5%) were Article, 606 (9.1%) were Meeting Abstract, 361(5.4%) were Proceedings Paper, 353 (5.3%) were Review and other (Letter (433), editorial material (407), early access (95), correction (54), note (35), book chapter (22), news item (4), retracted publication (4), retraction (4), correction addition (2), bibliography (1), book review (1), discussion (1), reprint (1)).

The bibliometric analyses were performed using 4692 articles. Of 4692 articles, 4355 (92.8%) were written in English and those remaining were written in German (114), French (89), Spanish (46), Turkish (39), Italian (23), Korean (9), Portuguese (8), Polish (4), Russian (2), Dutch (1), Greek (1), and Hungarian (1). The total number of citations in 4692 articles was 81401, the average number of citations per article was 17,35 with h index of 104.

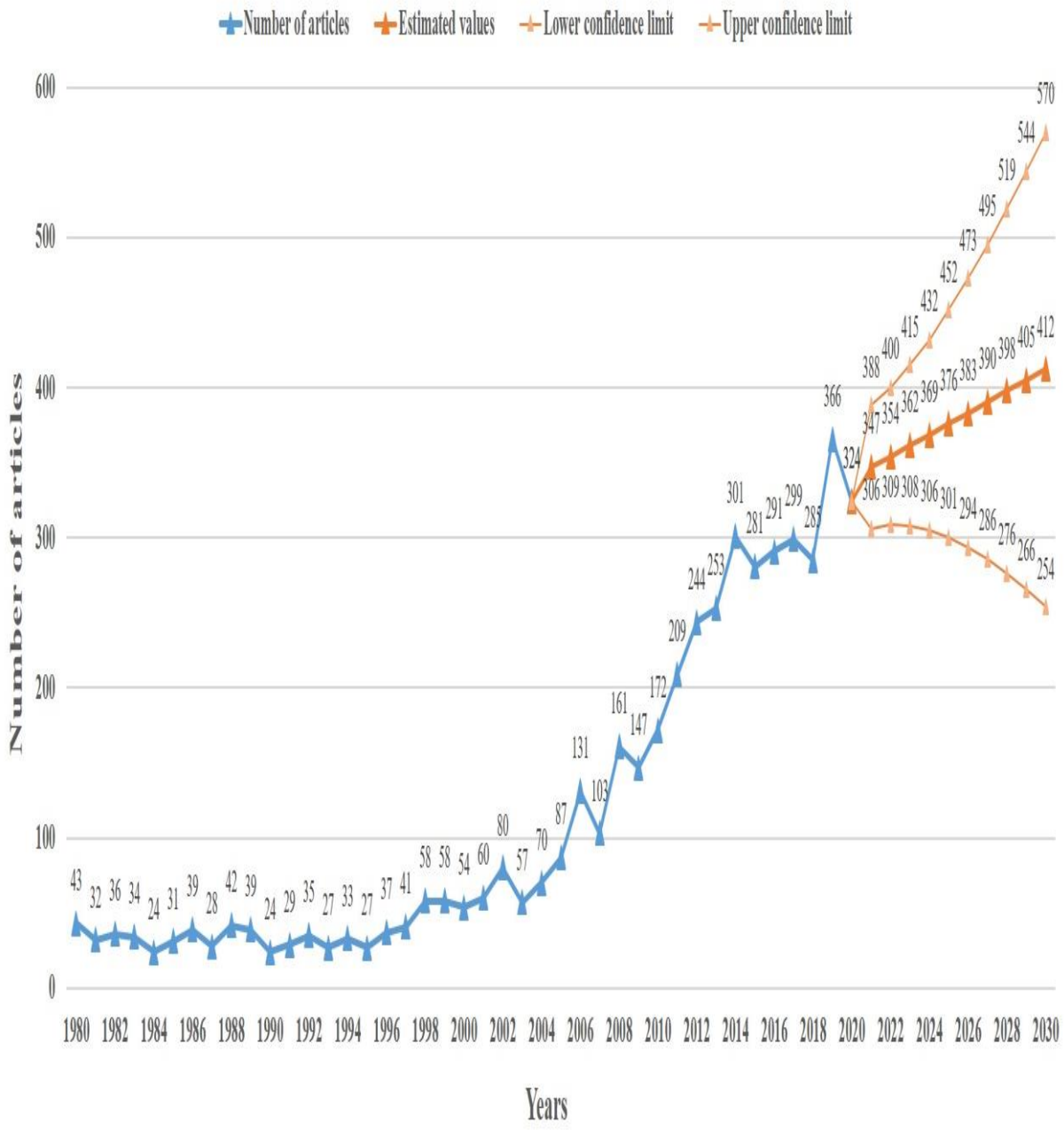
Active Research Areas

The most active 10 research areas on which most studies have been performed in the topic of thyroidectomy were Surgery (2402, 51.2%), Otorhinolaryngology (735, 15.7%), Endocrinology Metabolism (553, 11.8%), Medicine General Internal (442, 9.4%), Oncology (249, 5.3%), Medicine Research Experimental (240, 5.1%), Anesthesiology (153, 3.3), Radiology Nuclear Medicine Medical Imaging (88, 1.9%), Pharmacology Pharmacy (62, 1.3%), and Pediatrics (61, 1.3%).

Development of Publications

The distribution of the publications by years is given in Figure 1. Moreover, the results of regression analyses to estimate the number of articles likely to be published between 2021 and 2030 are shown in Figure 1. Based on the results of the regression analysis, 347 articles are expected to be published in 2021 (CI%: 306-388), while 412 articles in 2030 (CI%: 254-570) (Figure 1).

Figure 1. Distribution of articles on thyroidectomy by years



Active Countries

The distribution of world countries generating most publications is shown in Figure 2. The top 13 countries generating more than 100 articles were the USA (1004, 21.3%), South Korea (528, 11.2%), Italy (483, 10.2%), China (406, 8.6%), Turkey (302, 6.4%), Germany (261, 5.1%), France (219, 4.6%), Japan (205, 4.3%), UK (198, 3.4%), India (181, 3.8%), Taiwan (114, 2.4%), Canada (113, 2.4%), and Australia (107, 2.2%).

Correlation analysis

A statistically significant correlation was found between the number of articles on thyroidectomy generated by the countries and GDP, GDP PPP and HDI ($r=0.713$, $p<0.001$; $r=0.701$ $p<0.001$, $r=0.655$, $p<0.001$).

Active Authors

The top 15 authors who have published most articles on thyroidectomy were Dionigi G (85), Kim HY (71), Miccoli P (59), Chung WY (58), Tufano RP (52), Wu CW (49), Dralle H (48), Randolph GW (48), Chiang FY (47), Terris DJ (46), Materazzi G (42), Nam KH (41), Kandil E (39), Lee KE (39), and Lombardi CP (39).

Active Institutions

The most active 20 universities which published most articles on thyroidectomy were Yonsei University (100), Korea University (82), Seoul National University (79), University Pisa (66), Johns Hopkins University (54), Kaohsiung Medical University (54), Catholic University Korea (53), University Messina (53), University Wisconsin (52), İstanbul University (49), Jilin University (46), Sungkyunkwan University (45), Tulane University (44), University Sydney (43), University Hong Kong (42), University Ulsan (42), University Calif San Francisco (41), Harvard University (39), University Cattolica Sacro Cuore (38), and Memorial Sloan Kettering Cancer Center (37).

Active Journals

There were 50 journals where 20 and higher articles on thyroidectomy have been published. These active journals, the total number of citations in these journals, and the number of citations per article are shown in Figure 2. Moreover, the average citation network visualization map including these 50 journals is shown in Figure 3.

Figure 2. World map showing the distribution of articles on thyroidectomy by Country

Footnote: Article productivity increases from green to red in the indicator at the bottom left of the figure

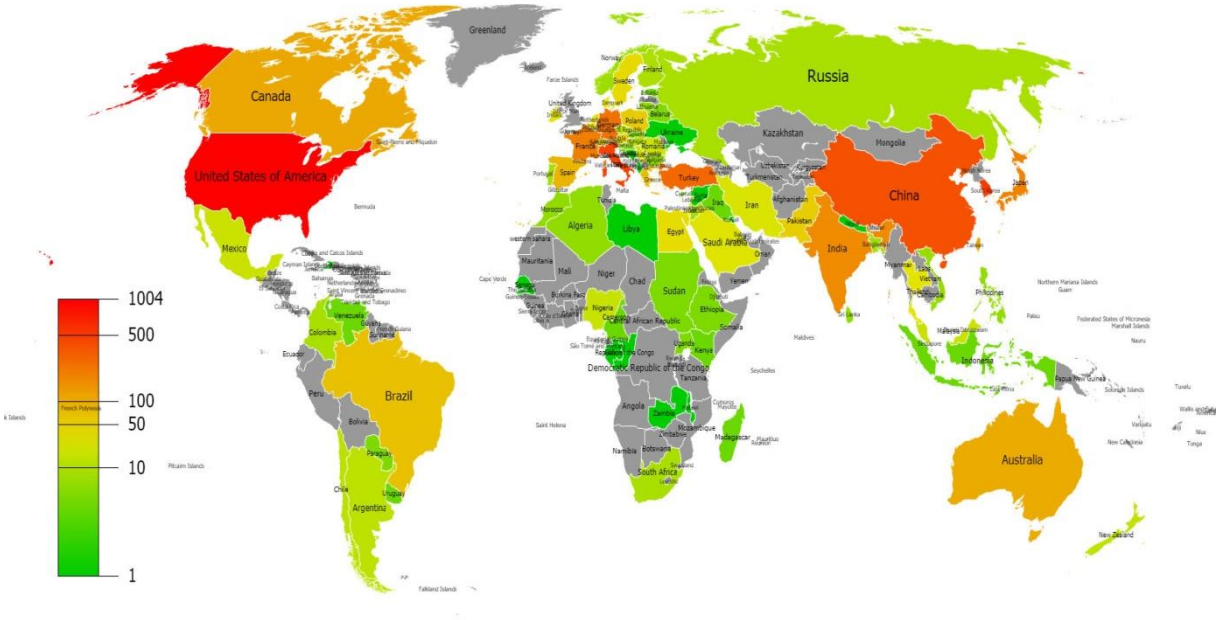
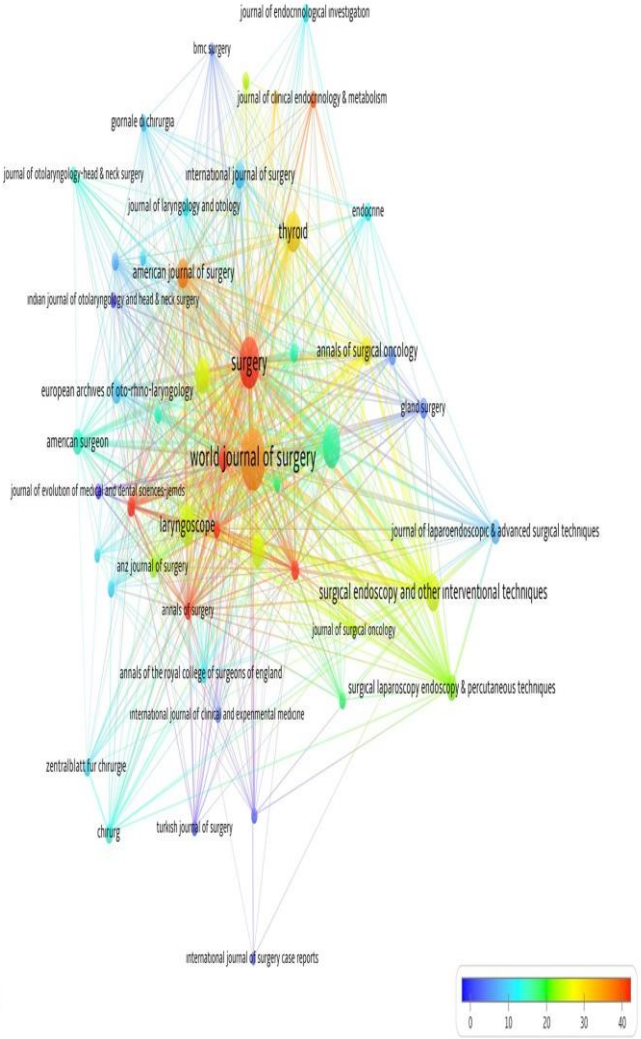


Figure 3. Network visualization map for citation analysis of journals that produce publications on thyroidectomy. *Footnote:* The size of the circle area indicates that the number of articles produced is greater. Indicator shows current publications from blue to red

Journals	RC	%	C	AC
World Journal of Surgery	240	5.12	8573	35.7
Surgery	172	3.67	7389	43.0
Head and Neck-Journal for the Sciences and Specialties of the Head and Neck	136	2.90	2226	16.4
Thyroid	116	2.47	3469	29.9
Laryngoscope	113	2.41	2814	24.9
Surgical Endoscopy and Other Interventional Techniques	99	2.11	2482	25.1
Otolaryngology-Head and Neck Surgery	96	2.05	2431	25.3
Langenbecks Archives of Surgery	81	1.73	2033	25.1
American Journal of Surgery	69	1.47	2479	35.9
Annals of Surgical Oncology	65	1.39	1788	27.5
International Journal of Surgery	59	1.26	556	9.4
Surgical Laparoscopy Endoscopy & Percutaneous Techniques	57	1.21	1267	22.2
American Surgeon	56	1.19	829	14.8
British Journal of Surgery	52	1.11	2036	39.2
European Archives of Oto-Rhino-Laryngology	52	1.11	499	9.6
Journal of Laparoendoscopic & Advanced Surgical Techniques	51	1.09	429	8.4
Anz Journal of Surgery	41	0.87	963	23.5
Gland Surgery	40	0.85	186	4.7
Journal of Surgical Research	36	0.77	567	15.8
Chirurg	35	0.75	496	14.2
Journal of the American College of Surgeons	35	0.75	1493	42.7
Archives of Surgery	34	0.72	2249	66.1
Annali Italiani Di Chirurgia	33	0.70	250	7.6
Medicine	33	0.70	185	5.6
Endocrine	31	0.66	383	12.4



Journals	RC	%	C	AC
Journal of Endocrinological Investigation	31	0.66	358	11.5
Journal of Laryngology and Otology	31	0.66	376	12.1
Annals of the Royal College of Surgeons of England	30	0.64	388	12.9
Archives of Otolaryngology-Head & Neck Surgery	30	0.64	1387	46.2
Giornale Di Chirurgia	30	0.64	280	9.3
Journal of Clinical Endocrinology & Metabolism	30	0.64	1136	37.9
Surgery Today	30	0.64	459	15.3
Zentralblatt Fur Chirurgie	30	0.64	318	10.6
Clinical Endocrinology	29	0.62	702	24.2
International Surgery	29	0.62	300	10.3
Annals of Surgery	28	0.60	3450	123.2
Journal of Pediatric Surgery	28	0.60	504	18.0
Endocrine Journal	27	0.58	476	17.6
Turkish Journal of Surgery	27	0.58	48	1.8
Journal of Evolution of Medical and Dental Sciences-Jemds	26	0.55	3	0.1
Journal of Surgical Oncology	26	0.55	627	24.1
İndian Journal of Otolaryngology and Head & Neck Surgery	26	0.55	31	1.2
Indian Journal of Surgery	26	0.55	52	2.0
Journal of Otolaryngology-Head & Neck Surgery	25	0.53	360	14.4
Annales De Chirurgie	24	0.51	256	10.7
International Journal of Clinical and Experimental Medicine	24	0.51	109	4.5
Acta Chirurgica Belgica	21	0.45	222	10.6
BMC Surgery	20	0.43	107	5.4
European Journal of Endocrinology	20	0.43	624	31.2
International Journal of Surgery Case Reports	20	0.43	54	2.7

Citation Analysis

The most cited 20 articles about thyroidectomy are shown in Table 1. The left column of

Table 1 shows the average number of citations of articles per year.

Table 1. Top 20 most cited articles according to total citations on thyroidectomy

No	Article	Author	Journal	PY	TC	AC
1	The importance of surgeon experience for clinical and economic outcomes from thyroidectomy	Sosa, JA. et al.	Annals of Surgery	1998	674	29.3
2	Estimating Risk of Recurrence in Differentiated Thyroid Cancer After Total Thyroidectomy and Radioactive Iodine Remnant Ablation: Using Response to Therapy Variables to Modify the Initial Risk Estimates Predicted by the New American Thyroid Association Staging System	Tuttle, RM. et al.	Thyroid	2010	465	42.27
3	Complications of thyroid surgery: Analysis of a multicentric study on 14,934 patients operated on in Italy over 5 years	Rosato, L. et al.	World Journal of Surgery	2004	465	27.35
4	Complications to thyroid surgery: results as reported in a database from a multicenter audit comprising 3,660 patients	Bergenfelz, A. et al.	Langenbecks Archives of Surgery	2008	376	28.92
5	Risk factors of paralysis and functional outcome after recurrent laryngeal nerve monitoring in thyroid surgery	Dralle, H. et al.	Surgery	2004	373	21.94
6	Hypocalcemia following thyroid surgery: Incidence and prediction of outcome	Pattou, F. et al.	World Journal of Surgery	1998	339	14.74
7	Predictive DNA testing and prophylactic thyroidectomy in patients at risk for multiple endocrine neoplasia type 2A	WELLS, SA. et al.	Annals of Surgery	1994	325	12.04
8	Scarless endoscopic thyroidectomy: Breast approach for better cosmesis	Ohgami, M. et al.	Surgical Laparoscopy Endoscopy & Percutaneous Techniques	2000	322	15.33
9	Morbidity of thyroid surgery	Bergamaschi, R. et al.	American Journal of Surgery	1998	300	13.04
10	Intraoperative monitoring of the recurrent laryngeal nerve in thyroid surgery	Dralle, H. et al.	World Journal of Surgery	2008	290	22.31
11	Total thyroidectomy - the treatment of choice for patients with differentiated thyroid-cancer	CLARK, OH	Annals of Surgery	1982	281	7.21
12	The impact of surgical technique on postoperative hypoparathyroidism in bilateral thyroid surgery: A multivariate analysis of 5846 consecutive patients	Thomusch, O. et al.	Surgery	2003	272	15.11
13	Robotic thyroid surgery using a gasless, transaxillary approach and the da Vinci S system: The operative outcomes of 338 consecutive patients	Kang, SW. et al.	Surgery	2009	268	22.33
14	Total thyroidectomy plus neck dissection in differentiated papillary thyroid carcinoma patients - Pattern of nodal metastasis, morbidity, recurrence, and postoperative levels of serum parathyroid hormone	Roh, JL. et al.	Annals of Surgery	2007	267	19.07

15	Randomized clinical trial of visualization versus neuromonitoring of recurrent laryngeal nerves during thyroidectomy	Barczynski, M. et al.	British Journal of Surgery	2009	236	19.67
16	Prophylactic thyroidectomy in multiple endocrine neoplasia type 2A	Skinner, MA. et al.	New England Journal of Medicine	2005	227	14.19
17	Comparison between minimally invasive video-assisted thyroidectomy and conventional thyroidectomy: A prospective randomized study	Miccoli, P. et al.	Surgery	2001	225	11.25
18	Complications of thyroid surgery: How to avoid them, how to manage them, and observations on their possible effect on the whole patient	Reeve, T. et al.	World Journal of Surgery	2000	225	10.71
19	Assessment of the morbidity and complications of total thyroidectomy	Bhattacharyya, N. et al.	Archives of Otolaryngology-Head & Neck Surgery	2002	206	10.84
20	Prospective study of postoperative complications after total thyroidectomy for multinodular goiters by surgeons with experience in endocrine surgery	Rios-Zambudio, A. et al.	Annals of Surgery	2004	204	12

PY: Publication year, TC: Total citation, AC: Average citations per year

Co-citation Analysis

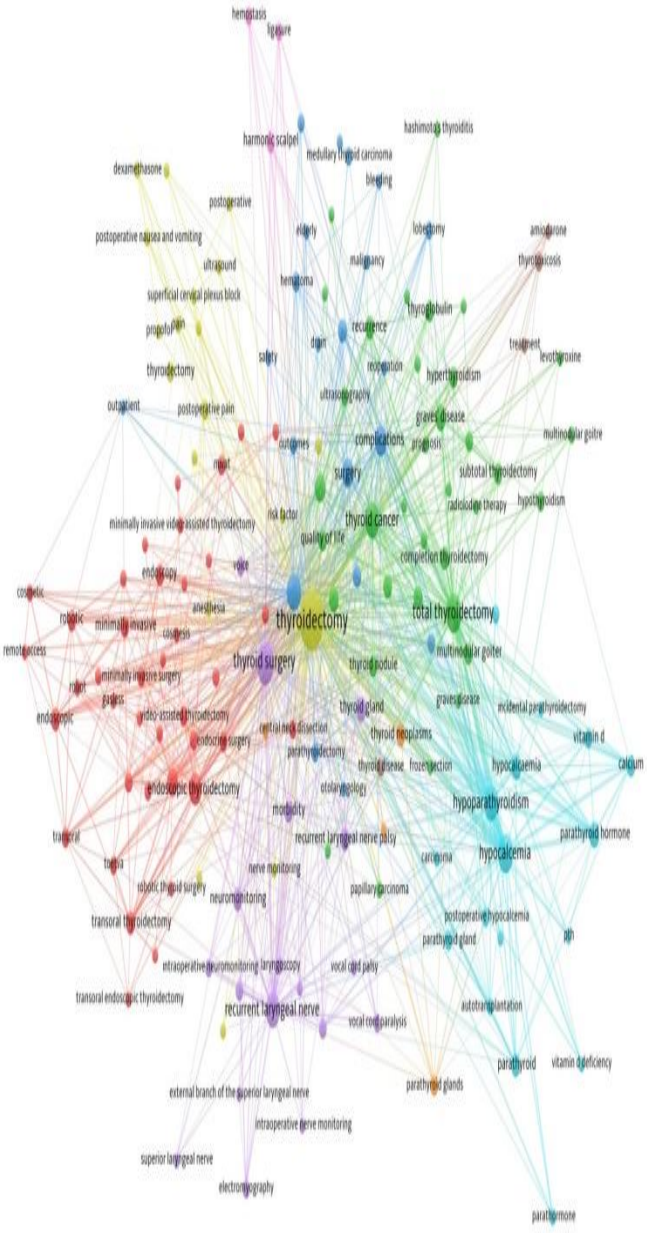
A total of 41022 publications were cited in the references section of all the analyzed articles. The top 11 studies with more than 170 citations were Cooper, (2009) (number of co-citation: 274), Rosato (2004), (262), Haugen (2016), (233), Pattou (1998), (229), Huscher (1997), (227), Gagner (1996), (218), Ohgami (2000) (198), Bergamaschi (1998) (197), Sosa (1998) (192), Randolph (2011) (189), and Thomusch (2000) (181) [1-4, 20-26]

Keyword Analysis and Trend Topics

4261 keywords were used in 4692 articles. Among them, 160 keywords used in at least 10 different articles are shown in Figure 4. The cluster analysis between these keywords is given in Figure 3. The trend visualization network map is given in Figure 5.a and the citation network map in Figure 5.b. The distribution of articles produced on endoscopic, robotic and transoral surgery by year was shown in Figure 6.

Figure 4. Network visualization map for cluster analysis based on keyword analysis on thyroidectomy *Footnote:* The colors indicate the clusters, the size of the circle area indicates that the number of articles produced is greater, and the thickness of the lines indicates the strength of relationship

Keyword	0	Keyword	0
thyroidectomy	1261	completion thyroidectomy	41
thyroid surgery	375	thyroid neoplasms	41
total thyroidectomy	284	neuromonitoring	40
hypocalcemia	248	papillary thyroid cancer	40
thyroid	231	calcium	39
thyroid cancer	207	harmonic scalpel	39
hypoparathyroidism	190	hyperthyroidism	39
recurrent laryngeal nerve	184	subtotal thyroidectomy	38
endoscopic thyroidectomy	138	postoperative complications	37
complications	129	minimally invasive	35
surgery	106	endoscopy	34
robotic thyroidectomy	81	thyroglobulin	33
papillary thyroid carcinoma	77	morbidity	32
hypocalcaemia	72	multinodular goiter	32
graves' disease	71	quality of life	32
parathyroid hormone	63	robotic	32
thyroid carcinoma	57	thyroid nodule	32
thyroid gland	54	differentiated thyroid cancer	31
transoral thyroidectomy	48	vitamin d	31
recurrent laryngeal nerve palsy	47	bilateral axillo-breast approach	30
recurrence	45	thyroidectomy	30
goiter	44	hypothyroidism	29
complication	43	parathyroid gland	29
endoscopic	43	parathyroidectomy	29
parathyroid	42	postoperative pain	29



Keyword	0	Keyword	0
recurrent laryngeal nerve injury	29	toetva	21
transoral	29	thyroid disease	20
endocrine surgery	28	goitre	19
intraoperative neuromonitoring	28	lobectomy	19
minimally invasive surgery	28	papillary thyroid microcarcinoma	19
minimally invasive thyroidectomy	28	postoperative hypocalcemia	19
risk factors	28	central neck dissection	18
hematoma	25	drainage	18
mivat	24	endoscopic surgery	18
parathyroid glands	24	hemithyroidectomy	17
thyrotoxicosis	24	meta-analysis	17
video-assisted thyroidectomy	24	minimally invasive video-assisted thyroidectomy	17
voice	24	postoperative nausea and vomiting	17
hemostasis	23	robot	17
learning curve	23	transaxillary	17
medullary thyroid carcinoma	23	parathormone	16
outcomes	23	dexamethasone	15
vocal cord paralysis	23	differentiated thyroid carcinoma	15
ligasure	22	laryngoscopy	15
ultrasonography	22	neck dissection	15
electromyography	21	robotic surgery	15
intraoperative neuromonitoring	21		

Figure 5.a. Network visualization map for trends based on keyword analysis on thyroidectomy *Footnote:* Indicator shows current articles from blue to red, the size of the circle area indicates that the number of articles produced is greater **5.b.** Network visualization map for citations based on keyword analysis on thyroidectomy *Footnote:* The number of citations from blue to red (blue-green-yellow-red) increases, the size of the circle area indicates that the number of articles produced is greater

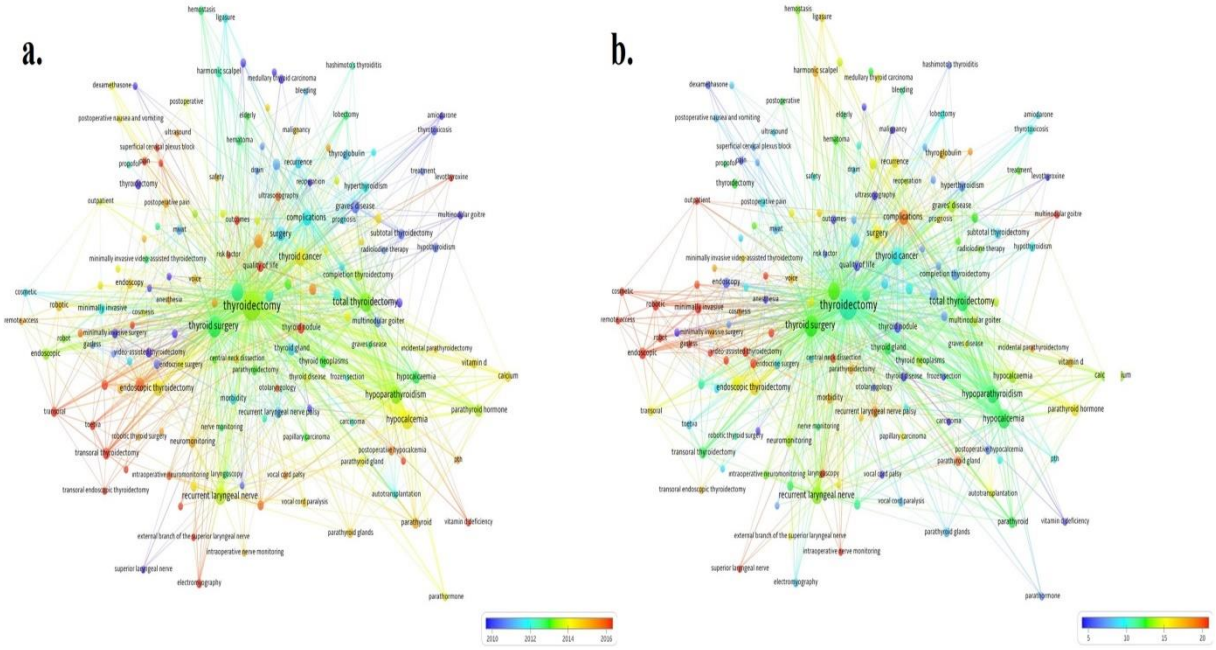
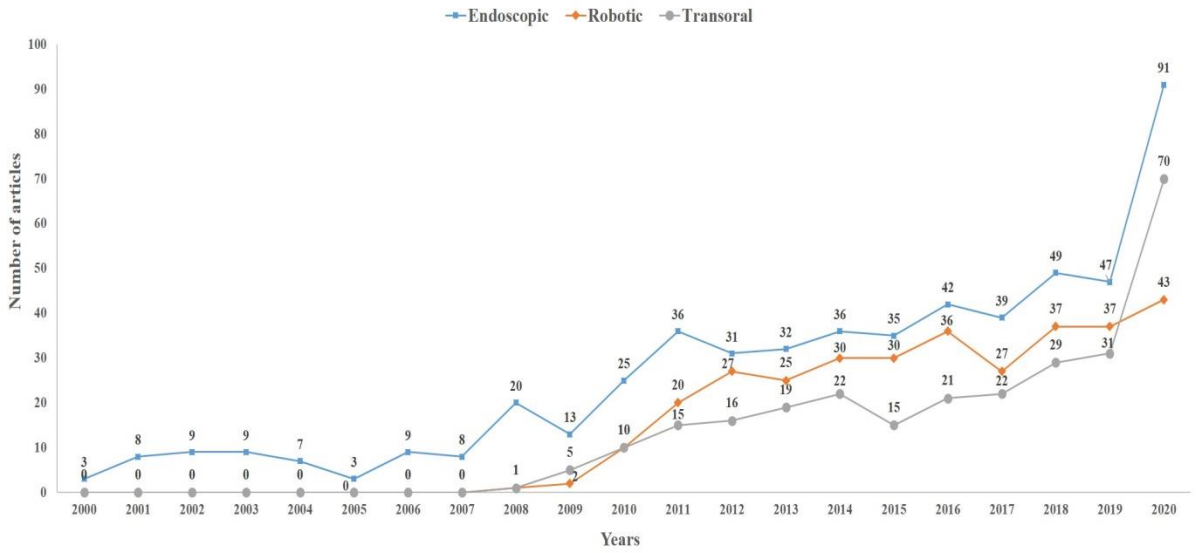


Figure 6. Distribution of endoscopic, robotic and transoral surgery articles by year



Discussion

The results of our study showed that the number of articles on thyroidectomy is ever increasing with a linear trend. The number of articles, which was low initially (min-max: 24-87), reached 100 and 366 in 2006 and in 2019 respectively. The regression analysis results suggested that the number of articles will continue to be in an uptrend. The American Thyroid Association (ATA) published guidelines for the management of thyroid diseases in 2006 and then revised them in line with related significant scientific advancements in 2009 and 2016. It is thought that the increase in the number of publications since 2006 might be linked with the publication of the ATA guideline, and the recent increase in the number of publications might be associated with the increasing interest in this topic due to ever-increasing prevalence rate.

The incidence of thyroid cancer is increasing in high-income countries (27). The map showing the article productivity of world countries is parallel with the world map produced by Kim et al. (2020) that shows the incidence rates of thyroid cancer (27). La Vecchia et al. (2014) reported that the incidence rate of thyroid cancer is higher for both women and men in high-income countries (Europe, Australia, South Korea, Japan, Chile, USA, and Canada) as compared to low- and middle-income countries (28). Deng et al. (2020), in their cross-sectional epidemiologic study covering a period from 1990 to 2017 in 195 countries and 21 regions, reported that almost half of the thyroid cancer burden was noted in Southern and Eastern Asia, and a third of patients with thyroid cancer resided in countries with a high sociodemographic index (29). In our study, South Korea, China, Japan, and Taiwan, which are among Eastern Asia countries, are among the top 11 countries with the highest article productivity. When the results of our study were evaluated with the literature findings, it was thought that the most important factors in publication productivity are the incidence rates of thyroid cancer and the development level of the countries. The results of the correlation analysis between article productivity and some development indicators, which were found significant, supported this conclusion.

Many bibliometric studies in the literature have found that geographical locations play an important role in international collaboration in co-authorship (15,16). The results of our study may suggest that although there are some small geographical collaborations on thyroidectomy, geographical neighborhood does not play a role in cooperation.

The most active journals in publishing articles were World Journal of Surgery, Surgery, Head and Neck-Journal for the Sciences and Specialties of the Head and Neck, Thyroid, Laryngoscope, and Surgical Endoscopy and Other Interventional Techniques, respectively. Authors who want to produce publication regarding this topic may consider these journals. Among journals producing 20 articles and higher, those with the highest number of citations per article included Annals of Surgery, Archives of Surgery, Archives of Otolaryngology-Head & Neck Surgery, Surgery, Journal of the American College of Surgeons, British Journal of Surgery, Journal of Clinical Endocrinology & Metabolism, American Journal of Surgery, and World Journal of Surgery, respectively. Researchers who want their articles to be more active may consider these journals.

When the analyzed articles were evaluated by the total number of citations, the study that has received the highest citation was found to be the study by Sosa et al. (1998) titled "The importance of surgeon experience for clinical and economic outcomes from thyroidectomy" (24). This was followed by the article by Tuttle et al. (2010) published in Thyroid journal [30]. The third study that received the highest citation was the study by Rosato et al. (2004) about complications of thyroid surgery that was published in the journal of World Journal of Surgery (4). In terms of the average number of citations per year, the most active article was the study by Tuttle et al. (2010) (30). The second most active article was the study by Anuwong et al. (2018) titled "Safety and outcomes of the transoral endoscopic thyroidectomy vestibular approach" published in the journal of JAMA surgery (31). This was followed by the studies by Adam et al. (2017) and by Anuwong (2016) (32,33). The top 5 studies that were co-cited by all the articles were the studies by Cooper, (2009), Rosato (2004), Haugen (2016), Pattou (1998), Huscher (1997). Researchers or clinicians who are interested in this topic may ideally read these publications at first.

The keyword analysis results showed that the clustering analysis resulted in clusters in 9 different colors (6 basic, 3 small). The basic clusters were divided into these topics; recurrent laryngeal nerve, hypoparathyroidism/hypocalcemia, endoscopic thyroidectomy/transoral thyroidectomy/robotic, total thyroidectomy/thyroid cancer, anesthesia/postoperative pain. Considering the studies in the literature so far, it could be noted that the studies were divided into thyroidectomy, complications, endoscopic surgery, and anesthesia. The trend keyword analysis results showed that the keyword that has been searched in recent years included transoral thyroidectomy (endoscopic and robotic), laparoscopic thyroidectomy, robotic thyroidectomy, toetva, bilateral axillo-breast approach, electromyography, recurrent laryngeal nerve injury, external branch of the superior laryngeal nerve, scar, superficial cervical plexus block, quality of life, outcomes, levothyroxine, vitamin D deficiency, permanent hypoparathyroidism. We observed in our bibliometric analysis that minimally invasive surgery has greater importance over time in thyroidectomy surgery. Endoscopic, robotic and transoral surgery is more popular especially in recent publications. We can say that traditional surgery is slowly falling behind. The most cited keywords were endoscopic, minimally invasive, robotic, cosmetic, transaxillary, remote access, gasless, video-assisted thyroidectomy, laryngoscopy, parathyroid gland, multinodular goitre, intraoperative nerve monitoring, superior laryngeal nerve, central neck dissection.

As a result of the literature review, we could not find any bibliometric study on thyroidectomy. It can be said that this comprehensive study is the first bibliometric study in this field. The basic level bibliographic study on thyroid research and practice by Bhutani et al. (2014) focused on the document types of articles on thyroidology (34). Our study is more comprehensive than this study. In our study, comprehensive evaluations such as citation analyses, keyword analyses, correlation analyses, international collaboration analyses were performed.

A limitation of the study may be the fact that we could not access the publications published before 1980. Because publications published before 1975 cannot be accessed in the WoS index. Another limitation is the fact that only the WoS index was used in the literature review, and another index such as PubMed, Scopus was not used. The PubMed database could not be used because it does not allow citation analysis (16). In the Scopus database, too many journals are indexed. We think that this is likely to affect the reliability of the study results. Since the WoS database indexes articles in journals with higher impact levels, it is more preferred in bibliometric analyses. The WoS database was used in most of the bibliometric studies conducted in recent years (8-18).

Conclusion

The aim of this study was to examine the progress of global studies of thyroidectomy surgery from 1980 to 2020. The results show that the number of studies has increased especially after the publication of the ATA guidelines. Endoscopic, robotic and transoral surgery has become a trend, and studies have focused on these areas recently. This study will provide useful guidance to scientists and clinicians about global thyroidectomy outputs. It will also provide insights to researchers who are intended to conduct a new study on thyroidectomy.

Funding/Support

The authors have no financial support or funding sources to declare.

Conflict of interest/Disclosure

The authors no conflict of interest to disclose.

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