



Narrative review article on epidemiology, diagnosis, treatment: a bibliometric analysis of the global scientific research progress on esophageal cancer

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Abstract: Esophageal cancer (EC) is 8th common cause of cancer death in the world. Moreover, it is considered a public health issues due to it is incredibly aggressive nature and poor survival rate. The study reviewed the epidemiology, diagnosis, treatment and provides an overview of the global scientific research on EC. Bibliometrics studies have played a fundamental role in decision making regarding policy formation and the prioritization of resources for public health challenges. The bibliometric analysis was conducted for studies published between 1961 and 2019 using medical subject headings (MeSH) database of the United States. VOSViewer and HistCite softwares were used for data analysis. Data was evaluated based on the title, trends, citations report, authorship, countries/regions, organizations, and journals. The total number of documents was 9,021, total citations was 222,721 and h-index was 160. Research article 7,871 (87.25%) and review paper 655 (7.26%), represent the majority of documents. The publications were rapidly increased during the period of 1985 to 2019. *Journal of Diseases of the Esophagus* and *Annals of Surgical Oncology* are leading journals. Doki Y, Wang Y and Kuwano H are most productive authors in EC research. Most published articles and leading funding agencies for EC research were from China, USA and Japan. The retrieved authors keywords were squamous cell carcinoma (SCC) and adenocarcinoma (AC). There is need for collaboration towards diagnostic and treatment of EC in the world and control the risk associated with EC.

Keywords: Esophageal cancer (EC); epidemiology; diagnosis; treatment; bibliometric analysis

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Introduction

Esophageal cancer (EC) rank 6th among the main causes of death (1), and 8th among types of cancer with a poor survival rate for 5 years (<20%) in the world (2,3). Evidence shows that EC is not common in the United States and Western societies, whereas in China represented 17,650 (1%) of tumors, 16,080 (2.6%) of cancer deaths and 50% of all new

cases (1).

Squamous cell carcinoma (SCC), was spread in the developing countries, while adenocarcinoma (AC) was spread in the developed countries (4,5). AC was associated with gastric reflux and Barrett's esophagus (4,6). Whereas, SCC was associated with alcohol consumption, hot tea drinking, red meat consumption, poor oral health, low intake of fresh fruits and vegetables, smoking and low

socioeconomic status (7-10). Clinical symptoms includes enlargement in lymph glands around the collarbone, dry cough, weight loss, and hematemesis and difficult in swallowing (11).

Poor nutrition, poor oral hygiene, and social deprivation were reported risk factors associated with EC in many countries. In addition the others risk actors were includes age, male gender, habits (tobacco use, alcohol, hot drinks, carbonated soft drinks consumption) (12,13), nutritional deficiencies (vitamin and mineral deficiencies), gastro-esophageal reflux disease (GERD), obesity, exposures to silica and asbestos, and low socioeconomic status (14,15). Esophageal squamous cell carcinoma (ESCC) geographic distribution varies significantly more than 10-fold between countries (16). The geographical variation reflect the genetic and environmental factors (17). We present the following article in accordance with the Narrative Review reporting checklist (available at <http://dx.doi.org/10.21037/dmr-20-121>).

Epidemiology of EC

SCC is a common histological subtype of EC in the world. The burden of EC occur within two geographic belts, one from North Central China through the Central Asian countries to Northern Iran, and the second from Eastern to Southern Africa (18). The incidence of AC was dramatically increased over the past 40 years in Western countries (18). Recently, AC was common in the United States, United Kingdom, and Australia (18). The highest incidences rate was reported in Eastern and Southeastern Asia, sub-Saharan Africa, and Central Asia (7,19,20). SCC incidence has escalated in few developing countries exceeding 100 per 100,000 per year, particularly in China and South Africa (21). In 2008, 482,000 people were diagnosed with EC, and 407,000 were died (22). EC was the 4th leading cause of death in African Americans. White have 2-fold risk of developing AC compared with Hispanics, and 3- to 4-fold increased risk compared with Blacks (23). In recent study, the incidence is high in black people and white women (24). The incidence of EC increased with a predictive model to 808,508 by 2035, causing 728,920 deaths (19,20).

In sub-Saharan Africa, the incidence of SCC has a regional variation, with the highest incidence rates in Southern and Eastern regions (17). The prevalence of SCC is higher than AC in Africa (25). Therefore, differences in risk factors were associated with regional variations (26,27). Previous studies showed that esophagus cancer was

common in Eastern Africa (28) and rare in Western Africa (17,29). Minimizing smoking and alcohol consumption reduced SCC cases by 13% in Uganda (30).

Risk factors of EC

Esophagus cancer is the less studied cancer, and has aggressive nature and poor survival rate (19). Many risk factors has been reported such as age, sex, alcohol consumption (31,32) smoking, tobacco use (33-35), hot tea drink, consumption of red meat, poor oral health, low intake of vegetables and fruits, reducing nutritional supplements intake such as selenium and zinc (31). A higher risk of SCC was associated with low socioeconomic status (19), medical history, obesity (34), exposure to environmental factor (31), diet and physical activity for both sexes (36) and other lifestyle, and medical factors (37). Sex, duration of smoking and BMI are associated with EC mortality (38).

Age and sex

Worldwide, the risk of AC was increased in individual older than 50 years (3). The majorities of new cases were diagnosed in people aged from 65 to 74 years (39). The male preponderance was (7:1) with 11:1 in those aged 50 to 54 and 4:1 in those aged 75 to 79. The prediction for males was irrespective of race (40).

Nutrition

Diet represents 30–35% of EC risk factors (41,42). High intakes of fruits and vegetables has a protective benefit against EC (43,44). In high-risk areas, poor nutritional is responsible for EC (45,46). Vitamin A, vitamin E, selenium, and zinc deficiencies were associated with SCC (47). The Seattle Barrett Esophagus Research Program demonstrated an association between the daily use of multivitamins, vitamin C, and vitamin E, and the reduction in the risk of AC (48). In contrast, carbohydrate intake was link with EC, in the United States carbohydrate intake increased EAC and decreased SCC (49).

Smoking and alcohol consumption

Tobacco use and alcohol consumption were major risk factors for EC (18,50), associated with the development of SCC (51). Smokers had 5 folds risk of developing EC compared to non smokers (19). In Taiwan, or was 4.2

and 3.4, for smokers and non smokers, respectively (52). The risk of alcohol increases with the amount of alcohol ingested ranged between 1.8 and 7.4 depend on the weekly volume consumption (52). The intake of specific types of drink creates “hot spots” in SCC (24). Whereas, in Northern China, the risk was not associated with alcohol consumption (52).

Obesity

Obesity is a risk factor for AC, and is a serious public health disease in the developed countries. In 2015, 75% of American population were overweight and 41% were obese (53). High level BMI was associated with increased risk for AC (54). The development of AC in obese patient was associated with increased incidence of GERD and hormonal dependent mechanism that mediated by inflammatory markers secreted by adipocytes (52).

Gastro-esophageal reflux disease (GERD)

GERD was risk factor for Barrett’s esophagus and esophageal AC (55,56). Patients having recurrent heartburn or regurgitation was increased the risk to AC 5-fold compared to those without GERD symptoms (57).

Pathogens infection

Several studies have found that Ethnicity is more likely associated with the development of EAC (58). People have decreased esophageal microbial richness and diversity in saliva microbial are prone to develop esophageal squamous dysplasia (59) the precursor of SCC in China (60). *Clostridiales* and *Erysipelotrichales* in the gastric corpus increase esophageal squamous dysplasia and SCC in Iran (61). *Porphyromonas gingivalis* was detected in 61% of SCC tissues compared with tissues from healthy people (62). The prevalence of HPV DNA in SCC tumor tissue was ranged from 0 to 70% (63). Serologic test for L1 and E6/E7 to determine the role of HPV in SCC etiology, identified only four positive SCC samples (64). In addition, lack of association between SCC and HPV DNA, HPV mRNA, or p16 (INK4a) up regulation was documented (65). Genome sequence studies did not find evidence for integration of HPV DNA in SCC (66). Kaposi sarcoma and SCC incidence rates was increased in Malawi (67). Association of HIV with SCC was reported in Zambia (68). Similarly, *Schistosoma mansoni* was associated SCC (69).

Diagnosis of EC

The clinical symptoms of EC include difficulty or pain on swallowing, progressive weight loss and cough. Patient may vomit blood or pass Malena, fatigue may occur due to anemia in the presence of chronic occult bleeding (70). Clinical investigation depend on evaluation of clinically apparent metastatic disease e.g., supraclavicular lymph nodes and hepatomegaly. Endoscopy, which may be enhanced using narrow-band imaging or Lugol’s solution for squamous dysplasia is the mainstay of evaluation (71).

Previous studies indicated that patient with EC was presented with dysphagia, prompting endoscopy and biopsy. The most useful imaging tools for diagnosis of clinical staging were computed tomography (CT) and positron-emission tomography (PET) (72). Patient presented with dysphagia have T2 or T3 disease (73).

A barium swallow coat the lining of esophagus and shown on the X-ray. The test is not using nowadays, tissue samples taken during an endoscopy is the best way to confirm a diagnosis (74).

The middle and upper third esophageal carcinomas were increased at the time of diagnosis. Bronchoscopy reveal either impingement or invasion of the main airways over 30% of new patients with cancer in the upper third of the esophagus. In some cases, bronchoscopy alone, can confirm that the tumor is locally unrespectable (75).

Treatment of EC

The management is generally similar for ESCC and AC, the difference is in choice of chemotherapy or surgery (76). The treatment was clearly presented in the guidelines for diagnosis and treatment of carcinoma of the esophagus (77). Generally EC management protocol includes endoscopic and surgical treatment, chemo-radiotherapy, molecular target therapy and palliative treatment. Mucosal cancers are cured used endoscopic mucosal resection (EMR) and endoscopic sub mucosal dissection (ESD). Lesion not exceed the mucosal layer (T1a), remaining within the mucosal epithelium (EP) or lamina propria mucosa (LPM) are extremely associated with LN metastasis (78). Surgery is a treatment for Tis, T1 and T2 carcinoma (79). Despite advances in surgery, long term survival after surgery only for advanced EC was remained poor, perioperative chemotherapy was improved survival rates. The advantage of adding chemotherapy to EC treatment decreased the risk of distant metastasis (80). Radiotherapy plus cetuximab

significantly improves overall survival for 5 years compared with radiotherapy alone for patients with locoregionally advanced head and neck cancers (81). A majority of EC patients required palliative therapy, because more than half of patients who are treated with curative intent developed tumor recurrence. Palliative chemotherapy is predominantly platinum and fluoropyrimidine based, while irinotecan may be an alternative in patients unsuitable for platinum (78).

Host genetics

Genetics analysis using high throughput sequencing technology was detected genomic alterations in SCC (74). The whole-genome sequencing, whole-exome sequencing, and array comparative genomic hybridization, identified more than 83% somatic mutation in SCCs (82). Detection of reliable markers to predict treatment outcome is still limited in the available medical research literature (74). Genetic polymorphisms may play important role in the carcinogenesis of EC (3).

Trend of EC in the world

Objective

The aim of the study is to review the epidemiology, diagnosis and treatment of EC, and provide an overview of the global scientific research in overall survival. The result will assist the decision makers at the national and international level, research organization, funding agencies for better understanding the growth and development of the research output on EC.

Methods

A comprehensive literature search of EC was conducted in July 15, 2020, the citation search was performed using Science Citation Index Expanded (SCI-E) and Social Science Citation Index (SSCI) of ISI Web of Science (WoS). Articles published in WoS were reviewed by two reviewers, THM and IHM, with respect to their year of publication, reported authors, country of origin, journals and the affiliated institutions of the authors. We performed the search on WoS using entry terms of the medical subject headings (MeSH) database of the US National Library of Medicine [National Institutes of Health (NIH)]. The used search term includes (esophagus*AND esophagus* carcinoma* OR cancer esophagus* OR cancer of the

esophagus*OR esophageal cancer* OR esophagus cancer* OR esophagus neoplasm* OR neoplasms, esophageal*). The filtered result contained 9,021 original articles and review paper. The bibliometric indicators included productive annual trends of publications, citation report, author names, affiliations, WoS subject categories, h-index (83), language, and journal names. The recent impact factor (IF) for each journal was obtained from 2020 journal citation reports (JCR) (84). There was no institutional review board approval required for this study, because WoS is a public database, and our research does not involve any human subjects.

Data analysis

Bibliometric analysis was performed using a quantitative analysis approach and knowledge mapping technique. Quantitative analysis was performed based on the WoS information. Knowledge mapping (i.e., network analysis) was performed using VOSViewer 1.6.10. (www.vosviewer.com) (85), to visualize the author keywords, countries, institutions and authors. HistCite software an open-source tool was used for analyzing the research productivity (86), in addition to a bibliometrix: a R-tool for comprehensive science mapping analysis (using R-studio cloud) was used (87,88).

Results

Characteristic of the retrieved documents

Bibliometric analysis was conducted for the published data of EC between 1961 and 2019. Total number of 9,021 documents, 222,721 citations and 160 h-indexes were reported. Average years from publication was 13.2, and the average citations per documents was 25.73. The documents were distributed research article 7,871 (87.25%), book chapter 4 (0.04%), early access 8 (0.09%), proceeding paper 479 (5.31%), retracted publication 4 (0.04%), and review paper 655 (7.26%) (*Table 1*). Bibliometric analysis was performed for article published in English 8,453 (94%), French 233 (3%), German 137 (2%), among others languages (*Figure 1*). The trend shows an increasing research production and total citation score start in 1980 (*Figure 2*).

Top journal cited EC articles

Among the top 16 journals each was contributed more than 100 published manuscripts. *Journal of Diseases of*

Table 1 Main information on EC documents

Description	Results
Timespan	1,961:2,019
Documents	9,021
Total citations	222,721
H-index	160
Average years from publication	13.2
Average citations per documents	25.73
Document types	
Article	7,871
Article; book chapter	4
Article; early access	8
Article; proceedings paper	479
Article; retracted publication	4
Review	655
Document contents	
Keywords plus	8,968
Author's keywords	8,826
Authors	
Authors	25,537
Author appearances	59,371

EC, esophageal cancer.

the Esophagus with (IF =2.388) was published the highest number of articles (n=401), followed by *Annals of Surgical Oncology* (IF =4.061) with published (n=194) articles, *Annals of Thoracic Surgery* (IF =3.639) and published (n=167) articles and *International Journal of Cancer* (IF =5.145) and published (n=166) articles in EC with high citation score [Total Global Citations Score (TGCS) =10,104] times (Table 2).

Top 10 highly cited authors

The study notice that the first top author based on TGCS is Doki Y published 93 articles with (TGCS =2,827) times. The second author is Wang Y published 83 articles with (TGCS =1,368) times, and the third author is Kuwano H published 82 articles with (TGCS =1,577). The top authors whom published more than 50 research article in EC are presented in Table 3.

Top 10 highly cited articles

Table 4 displays the top-cited articles on EC literature (1961–2019), where the first top article is entitled “Preoperative chemo-radiotherapy for esophageal or junctional cancer” with account of (TGCS =2,276) for article published by van Hagen *et al.* (2012), followed by “Medical progress esophageal cancer” published in 2008, and article entitled “Combined chemotherapy and radiotherapy compared with radiotherapy alone in patients with cancer of the esophagus” obtained (TGCS =1,493). The top 10 articles received citation range from 676 to 2,276. Collaboration in research provide opportunity to increase the impact and scope of research in EC. Collaboration of countries/regions involved in EC research is shown in Figure 3.

Co-citation analysis between authors and organization

Of 162 authors were distributed into six clusters with total length strength [total link strength (TLS) =3,514]. Doki Yuichiro reported high TLS (TLS =395), followed by Yamasaki Makoto (TLS =311), and Mori Masaki (TLS =288) (Figure 4). The total of 231 organizations were distributed into the eight clusters with TLS 5,361. Furthermore, the visualization results show that the Chinese Academy of Science was high rank (TLS =351), followed by the National Cancer Center (TLS =301), and the University of Texas (TLS =235) (Figure 5).

WoS categories

Oncology research covered 3,735 (41.403%) of scientific categories during the study period, followed by Surgery 2,177 (24.133%), gastroenterology hematology 1,663 (18.435%), radiology nuclear medicine medical image 582 (6.452%), respiratory system 492 (5.454%), general internal medicine 456 (5.055%), experimental medicine 363 (4.024%), cardiovascular system cardiology 344 (3.813%), and cell biology 283 (3.137%) (Figure 6).

Funding agencies

National Natural Science Foundation of China rank first 637 (7.061%) on supporting EC research, followed by United States Department of Health Human Services 544 (6.030%), NIH USA 541 (5.997%), NIH National Cancer Institute NCI 354 (3.924%), Ministry of Education, Culture, Sports, Science and Technology Japan MEXT 151 (1.674%), Japan Society for The Promotion of Science 65 (0.721%), NIH National Institute of Diabetes Digestive

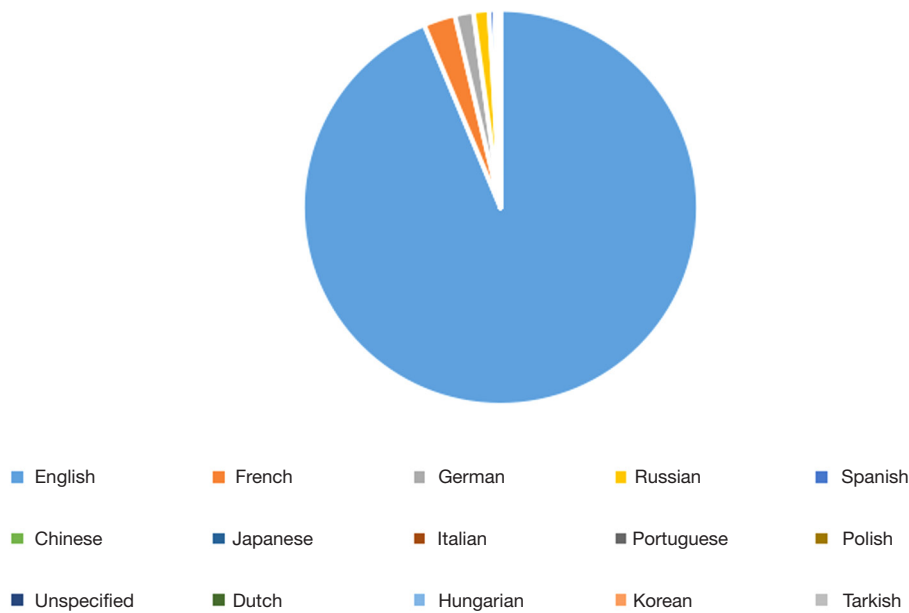


Figure 1 Language of publication on EC retrieved documents. EC, esophageal cancer.

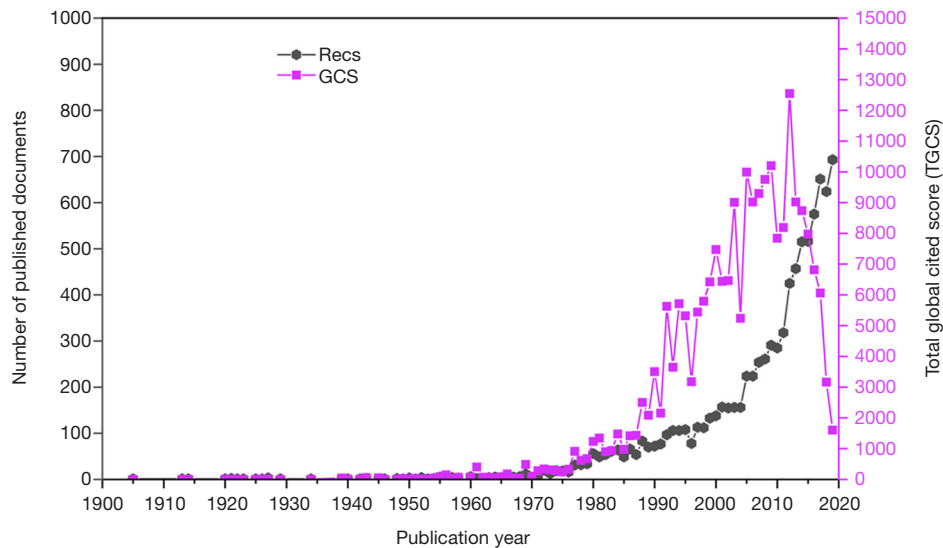


Figure 2 Annual trend of publications and TGCS in the field of EC research. TGCS, Total Global Citations Score; EC, esophageal cancer.

Kidney Diseases NIDDK 54 (0.599%), Natural Science Foundation of Jiangsu Province 53 (0.588%), National Basic Research Program of China 52 (0.576%), and Swedish Cancer Society 48 (0.532) (*Figure 7*).

Organizations-enhanced

The top most organization enhanced indexed in WoS

databases on EC are University of Texas system 287 (3.181%), followed by Zhengzhou University 261 (2.839%), UTMD Anderson Cancer Center 251 (2.782%), Chinese Academy of Medical Sciences, Peking Union Medical College 248 (2.749%), NIH USA 168 (1.862%), and NIH National Cancer Institute NCI 163 (1.807 %) (*Figure 8*).

Table 2 Top journals with the highly cited articles (more than 100 articles) on EC literature (1961–2019)

Rank	Journal (n=1,117)	Recs	TGCS	LCR	(IF, 2020)	Quartile*
1 st	<i>Diseases of the Esophagus</i>	401	6,267	2,247	2.388	Q3
2 nd	<i>Annals of Surgical Oncology</i>	194	4,773	1,273	4.061	Q1
3 rd	<i>Annals of Thoracic Surgery</i>	167	5,763	859	3.639	Q1
4 th	<i>International Journal of Cancer</i>	166	10,104	914	5.145	Q1
5 th	<i>Anticancer Research</i>	153	1,718	692	1.994	Q4
6 th	<i>IJROBP</i>	147	5,365	834	5.859	Q1
6 th	<i>World Journal of Gastroenterology</i>	145	3,435	838	3.665	Q2
8 th	<i>Esophagus</i>	123	983	591	3.13	Q3
9 th	<i>World Journal of Surgery</i>	118	3,333	677	2.234	Q2
10 th	<i>Annals of Surgery</i>	116	8,124	762	10.13	Q1
11 th	<i>Gastrointestinal Endoscopy</i>	114	5,176	529	6.89	Q1
12 th	<i>Cancer</i>	109	6,414	442	6.126	Q1
13 th	<i>Journal of Surgical Oncology</i>	105	2,392	546	2.771	Q2
14 th	<i>Hepato-Gastroenterology</i>	102	1,209	326	1.581	Q4
16 th	<i>PLoS One</i>	101	1,632	476	2.74	Q2

Quartile: *, Journals are ranked into four quartiles—Q1, Q2, Q3, and Q4 (Q1 being the highest) by Scimago. EC, esophageal cancer; LCR, local cited reference; TGCS, Total Global Cited Score; IF, 2020, impact factor 2020; IJROBP, International Journal of Radiation Oncology Biology Physics.

Table 3 Top authors with highly cited articles (more than 50 articles) on EC

Rank	Author	Recs	TLCS	TGCS	CR
1 st	Doki Y	93	545	2,827	543
2 nd	Wang Y	83	162	1,368	285
3 rd	Kuwano H	82	411	1,577	442
4 th	Kato H	76	374	1,966	514
5 th	Zhang Y	76	137	907	273
6 th	Mori M	72	347	1,874	318
7 th	Ajani JA	69	1,081	3,882	649
8 th	Li Y	67	75	827	252
9 th	Matsubara H	66	312	1,492	323
10 th	Watanabe M	66	258	1,178	367
11 th	Hofstetter WL	64	708	2,449	636
12 th	Li J	61	100	765	292
13 th	Wang J	60	89	666	244
14 th	Kitagawa Y	59	219	1,084	398

Table 3 (continued)

Table 3 (continued)

Rank	Author	Recs	TLCS	TGCS	CR
15 th	Komaki R	58	1,260	3,254	407
16 th	Dawsey SM	57	638	3,408	440
17 th	Zhang L	57	46	516	212
18 th	Lagergren J	56	259	1,471	239
19 th	Baba H	55	258	996	320
20 th	Miyazaki T	54	213	953	372
21 st	Holscher AH	53	407	1,418	480
22 nd	Miyata H	53	305	1,455	274
23 rd	Yamasaki M	53	279	1,280	287
24 th	Takahashi T	50	171	975	263
25 th	van Lanschot JJB	50	447	4,396	318

EC, esophageal cancer; TLCS, Total Local Citation Score; TGCS, Total Global Cited Score; CR, cited reference.

Table 4 The top 10 highly cited articles on EC literature (1961–2019)

Rank	Articles	TGCS	NA	CR	Study design
1 st	Van Hagen P, Hulshof MC, van Lanschot JJ, <i>et al.</i> Preoperative chemoradiotherapy for esophageal or junctional cancer. <i>N Engl J Med</i> 2012;366:2074-84	2,276	29	25	Randomized controlled trial
2 nd	Enzinger PC, Mayer RJ. Esophageal cancer. <i>N Engl J Med</i> 2003;349:2241-52	2,008	2	122	Review Article
3 rd	Herskovic A, Martz K, al-Sarraf M, <i>et al.</i> Combined chemotherapy and radiotherapy compared with radiotherapy alone in patients with cancer of the esophagus. <i>N Engl J Med</i> 1992;326:1593-8	1,493	10	26	Randomized controlled trial
4 th	Cooper JS, Guo MD, Herskovic A, <i>et al.</i> Chemoradiotherapy of locally advanced esophageal cancer: long-term follow-up of a prospective randomized trial (RTOG 85-01). Radiation Therapy Oncology Group. <i>JAMA</i> 1999;281:1623-7	1,161	13	19	Randomized controlled trial
5 th	Bosset JF, Gignoux M, Triboulet JP, <i>et al.</i> Chemoradiotherapy followed by surgery compared with surgery alone in squamous-cell cancer of the esophagus. <i>N Engl J Med</i> 1997;337:161-7	1,016	11	41	Randomized controlled trial
6 th	Kelsen DP, Ginsberg R, Pajak TF, <i>et al.</i> Chemotherapy followed by surgery compared with surgery alone for localized esophageal cancer. <i>N Engl J Med</i> 1998;339:1979-84	953	12	22	Randomized controlled trial
7 th	Minsky BD, Pajak TF, Ginsberg RJ, <i>et al.</i> INT 0123 (Radiation Therapy Oncology Group 94-05) phase III trial of combined-modality therapy for esophageal cancer: high-dose versus standard-dose radiation therapy. <i>J Clin Oncol</i> 2002;20:1167-74	910	9	16	Clinical trial
8 th	Tepper J, Krasna MJ, Niedzwiecki D, <i>et al.</i> Phase III trial of trimodality therapy with cisplatin, fluorouracil, radiotherapy, and surgery compared with surgery alone for esophageal cancer: CALGB 9781. <i>J Clin Oncol</i> 2008;26:1086-92	834	10	23	Randomized controlled trial
9 th	Bedenne L, Michel P, Bouché O, <i>et al.</i> Chemoradiation followed by surgery compared with chemoradiation alone in squamous cancer of the esophagus: FFCD 9102. <i>J Clin Oncol</i> 2007;25:1160-8	728	14	33	Randomized controlled trial
10 th	Akiyama H, Tsurumaru M, Udagawa H, <i>et al.</i> Radical lymph node dissection for cancer of the thoracic esophagus. <i>Ann Surg</i> 1994;220:364-72; discussion 372-3	676	4	23	Clinical trial

EC, esophageal cancer; TGCS, Total Global Citations Score; NA, number of authors; CR, cited reference.

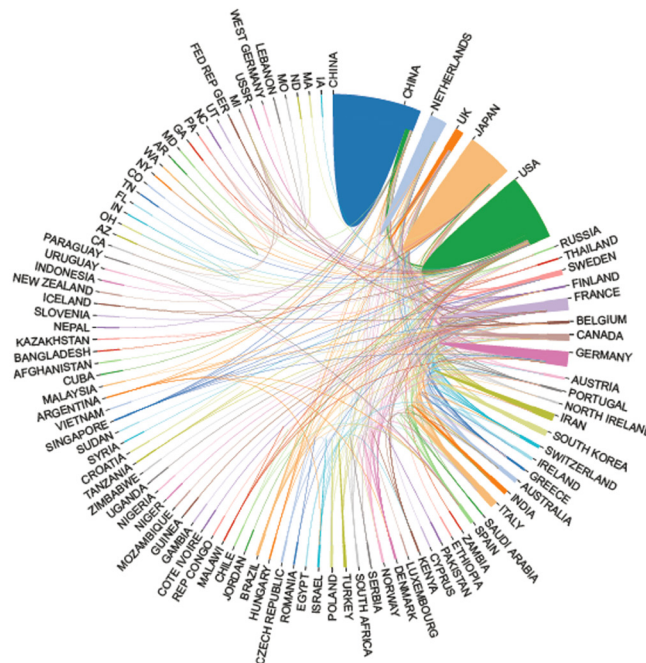


Figure 3 The collaboration of countries/regions involved in EC research. EC, esophageal cancer.

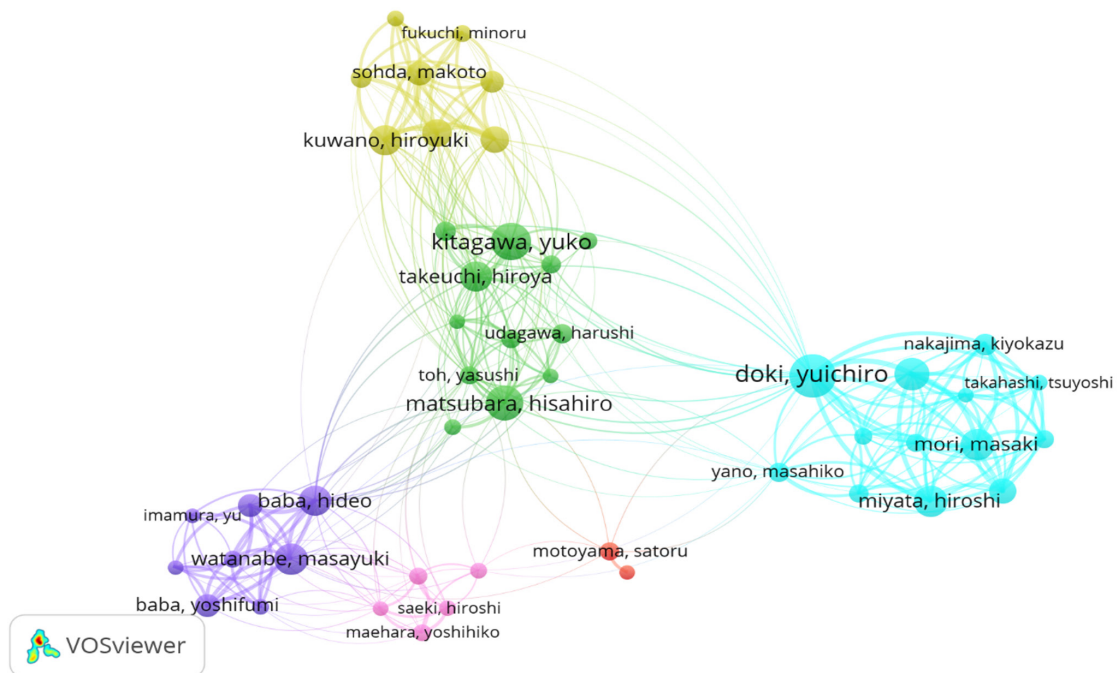


Figure 4 Co-citation analysis of the authorship analysis. Authors with 20 documents were selected which resulted to a threshold of 102. Weigh based on total link strength (TLS).

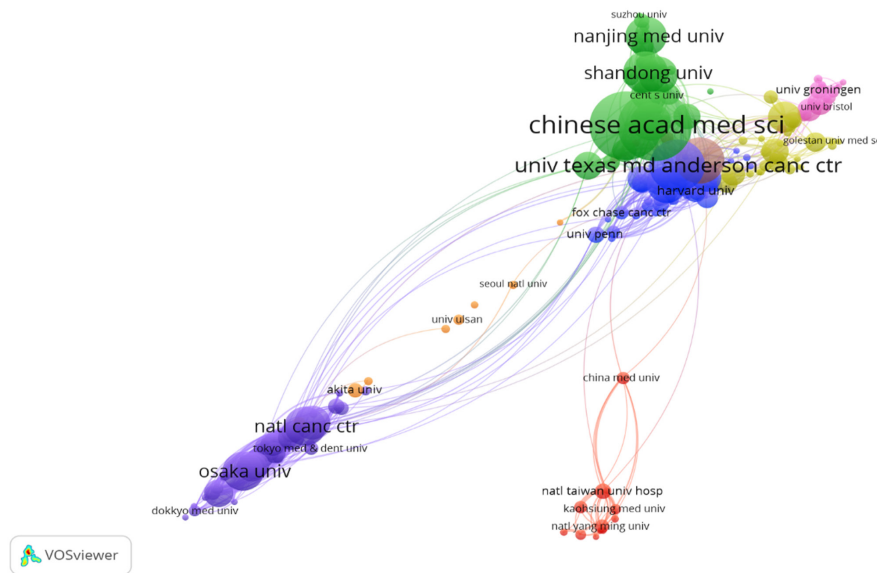


Figure 5 Co-citation of authors and organization enhanced research, with 15 documents were selected which resulted to a threshold of 231 organizations. Weigh by total link strength (TLS).

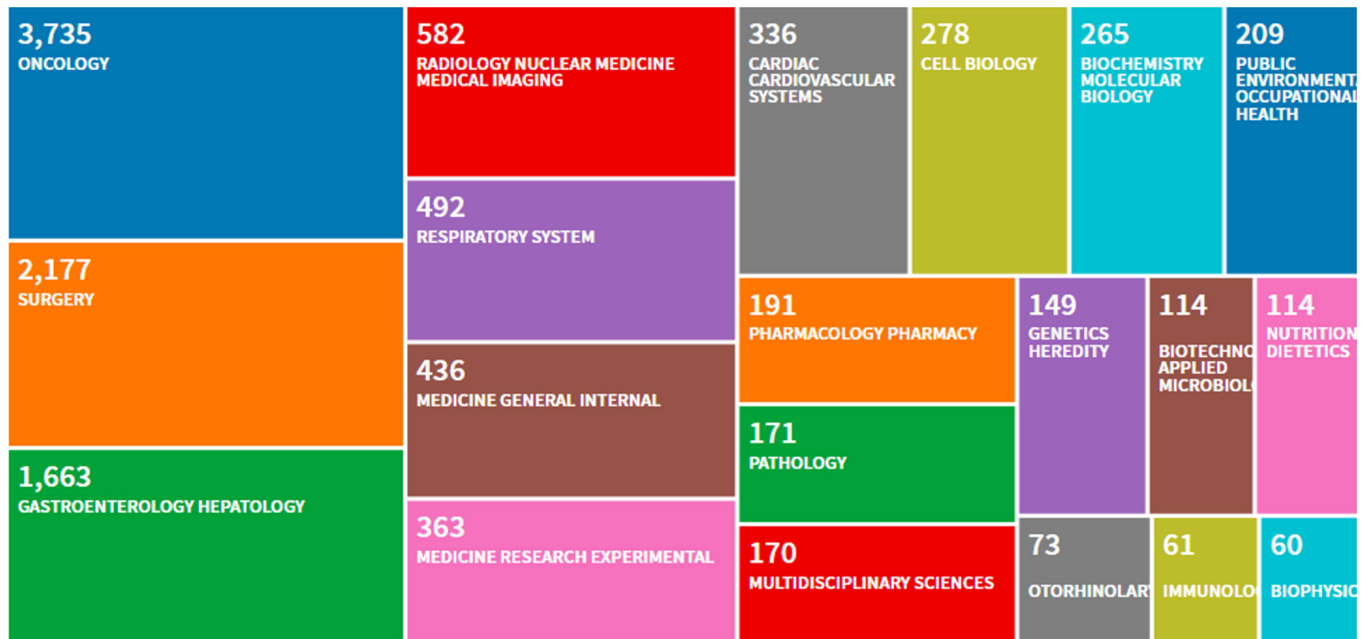


Figure 6 Top 20 WoS categories of EC research. WoS, Web of Science; EC, esophageal cancer.

Keywords analysis

EC, esophagectomy, prognosis and cancer were the most frequency used keywords Plus. SCC and AC were the most frequency authors keywords used on EC published documents. Whereas, cancer, esophageal and patients were

the most frequency keywords used in research title (Table 5).

Discussion

The EC was the main cause of cancer death in the world,

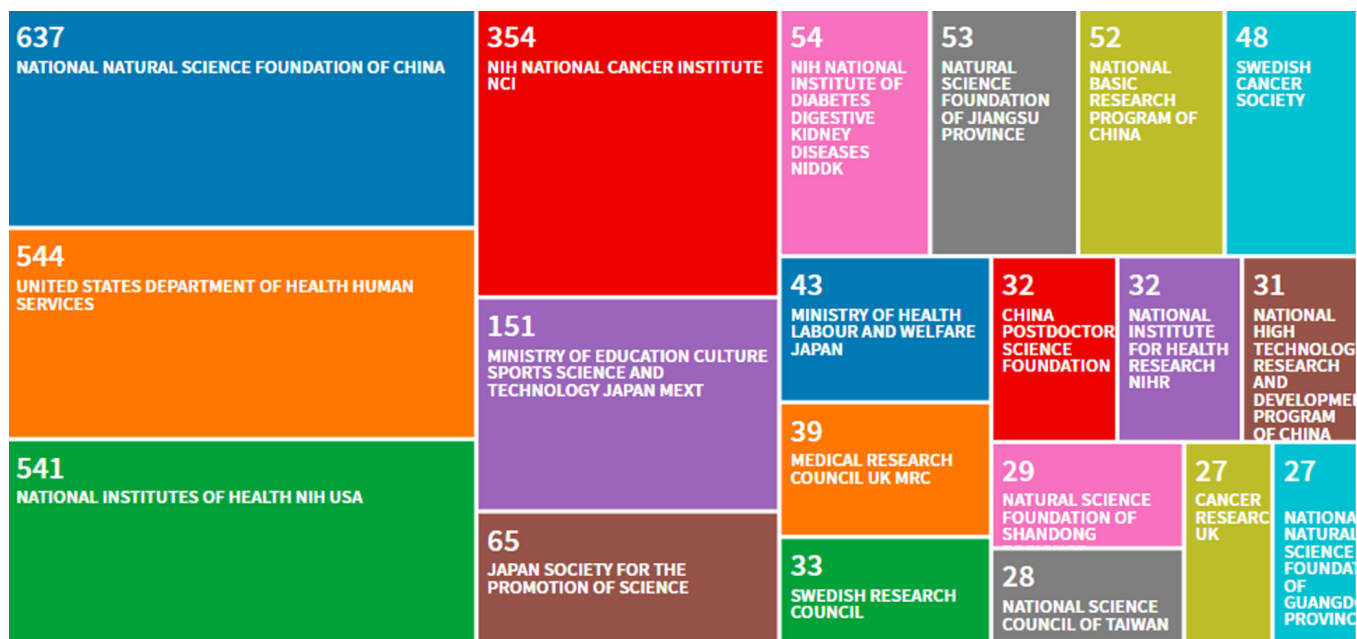


Figure 7 Top 20 funding agencies on supporting research on EC. EC, esophageal cancer.



Figure 8 Top 20 organizations-enhanced research on EC. EC, esophageal cancer.

with poor survival rate. A wealth of articles were published on esophagus cancer indexed in many database in the world. But there is no comprehensive bibliometric analysis to summarized EC research. In the present study we summarize the quantitative analysis of EC and research

trends. The frequency analysis of the growth and citation scores indicated a noticeable increase in the EC publications in the past years, and this may be due to implementation of surgery EC treatment. Since EC was ranked 6th causing cancer death worldwide (89), the incidence of new cancer

Table 5 Most frequency keywords in EC research

SN	Terms-keyword plus	Freq	Terms-authors keywords	Freq	Terms-title keywords	Freq
1	Esophageal cancer	3,303	Squamous-cell carcinoma	2,152	Cancer	8,585
2	Esophagectomy	437	Carcinoma	2,071	Esophageal	8,231
3	Prognosis	321	Adenocarcinoma	1,257	Patients	1,703
4	Cancer	302	Surgery	1,055	Esophagus	999
5	Radiotherapy	269	Chemotherapy	919	cell	786
6	Chemotherapy	259	Survival	876	Treatment	732
7	Chemoradiotherapy	253	Expression	814	Study	669
8	Esophagus	234	Chemoradiotherapy	758	Therapy	645
9	Esophageal neoplasms	230	Therapy	721	Risk	593
10	Esophageal squamous	228	Radiotherapy	597	Squamous	554
11	Survival	227	Resection	472	Esophagectomy	548
12	Esophageal	194	Risk	450	Cells	545
13	Esophageal carcinoma	186	Chemoradiation	446	Expression	488
14	Meta-analysis	163	Radiation-therapy	426	Advanced	467
15	Apoptosis	154	Trial	423	Chemoradiotherapy	465
16	Surgery	153	Barretts-esophagus	396	Surgery	463
17	Adenocarcinoma	118	Breast-cancer	351	Gastric	454
18	Metastasis	114	Mortality	343	Cancers	448
19	Gastric cancer	112	Lung-cancer	339	Survival	426
20	Squamous cell carcinoma	109	Positron-emission-tomography	303	Neoadjuvant	423
21	Neoadjuvant therapy	105	Cisplatin	286	Endoscopic	418
22	Chemoradiation	103	Gastric-cancer	285	Human	407
23	Cisplatin	99	Metastasis	277	Clinical	393
24	Epidemiology	93	Outcomes	277	Chemotherapy	364
25	Barrett's esophagus	92	Impact	255	Analysis	362

EC, esophageal cancer.

cases was 455,800 and the death was occurred in 400,200 cases (83). The rapid increase in the EC and noticeable contribution in publication growth during the period of 1985 to 2019 might be due to increased number of the scientific journal that indexed in WoS databases. Currently, the evidence highlighted that WoS platform includes over 21,000 of the highest impact journals worldwide.

As shown in the bibliometric mapping the most cited articles were “*Preoperative chemo-radiotherapy for esophageal or Junctional cancer*”, followed by “*Medical progress esophageal cancer*” and “*Combined chemotherapy and radiotherapy*

compared with radiotherapy alone in patients with cancer of the esophagus”. Whereas, most occurrence authors keywords retrieved were SCC and AC. The National Natural Science foundation, China is top funding agency for EC research. The underlying reasons might be due to their higher Gross Domestic Product (GDP) and fund used for research in well-developed countries compared with under developing countries.

Using of a bibliometric analysis is a straightforward for tracking research, standardized method of detecting the author keywords in the articles and assessing trends

frequency of reported keywords, link strengths, and gaps in any published literature. keywords analysis showed a 6-fold increased in the number of publications from 1961 to 2019. Our current bibliometric study was given a snapshot of the current situation based on certain keywords used by the authors.

Limitations

A bibliometric study was 100% accurate and perfect, was a snapshot of the current situation based on certain keywords used in EC data collection. However, the electronic database was not accurate for data collection. System updates, affiliation of the authors, different name spelling, and sometimes missing funding agency or electronic databases which commonly effected bibliometric studies.

Conclusions

This study provides an overview on the epidemiology, diagnosis, treatment and bibliometric analysis of the global scientific research progress in EC related field. EC ranks 6th in the world due to the mortality rate connected with malignant tumors, and it is eighth the most common cancer in the world. EC was associated with many risk factors such as age, sex, alcohol smoking, tobacco use, red meat, poor oral health, low intake of fresh food, and socioeconomic status. The study demonstrates that the literature on EC was continuously growing, in the field of SCC and AC. The efforts should be made by the developed countries to help developing countries with high prevalence of EC. National Natural Science Foundation of China and the United States Department of Health Human Services were the top funding agency on EC research. University of Texas and Chinese academy of medical sciences are the top organization enhance research on EC. Disease of the Esophagus was the top leading journal publishing articles on EC. China, USA and Japan are more productive countries on EC. There is need for collaboration towards diagnostic and treatment of EC in the world and control the risk associated with EC.

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Footnote

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