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SIRT Visualization and Hotspot Analysis Based on The Web of Science Database for the Treatment of Liver Neoplasms

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Abstract: Selective internal radiation therapy using yttrium-90 has been used to treat hepatocellular carcinoma, intrahepatic cholangiocarcinoma, and other malignant tumors that have spread to the liver locally. The authors used the bibliometric approach in response to the neoplasms, using the keyword "Yttrium 90 AND Liver Neoplasms" as a search parameter and then looked up pertinent English-language literature in the Web of Science core collection database's self-built database through November 30, 2025. For statistical analysis and literature management, EndNote and Excel tools were utilized. In addition to co-citation and emergent keyword analysis of authors, VOSviewer and CiteSpace were utilized for social network and chronological order of countries, institutions, authors, and keywords. The aim of this study was to serve as a reference for future research by methodically sorting through the international research literature on Yttrium 90 treatment of liver neoplasms and summarizing the research status and hot trends in this field. In recent years, research focus has increasingly shifted toward high-quality, multi-center clinical trials that combine SIRT-targeted systemic therapy with hepatectomy following the descending stage. This approach is likely to remain a significant research trend in the field.

Keywords: Yttrium-90; Liver neoplasms; Web of Science; CiteSpace; VOSviewer; Bibliometric method; Therapeutics

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1. Introduction

From third highest in 2018 to second highest in 2020, hepatocellular carcinoma has emerged as the leading cause of cancer death [1]. Because the majority of liver malignant tumor treatment is based on the patient's tumor burden and cancer-related symptoms [2] (2), some patients may be able to undergo surgical resection or liver transplantation if their tumors shrink or their staging decreases as a result of Selective internal radiation therapy using yttrium-90 (^{90}Y-SIRT) [3]. It has been demonstrated that ^{90}Y-SIRT is a successful therapeutic approach for liver-directed therapy, which may enhance the results of local control or make tumor reduction more operable [4–9].

^{90}Y-SIRT has been extensively employed in the local management of primary and secondary liver malignancies [10]. But metastatic liver malignant tumors from other sites cannot be easily equated with hepatocellular carcinoma because of the biological features and treatment approaches that differ among malignant tumors from different sources. Research and therapy of malignant tumors of the liver are thus faced with obstacles. In the last 20 years, a significant number of studies have been published due to the growing application of ^{90}Y-SIRT in the treatment of malignant tumors of the liver. In order to sort through the English literature on the treatment of liver malignant tumors with Yttrium 90 and analyze the current publication status and hot topics in order to provide references for future research, the authors use the method of bibliometrics to more thoroughly comb the development status of ^{90}Y-SIRT in the treatment of liver malignant tumors.

2. Materials and methods

The Web of Science Core Collection (WoSCC) database was searched using the phrases "Yttrium-90 and Liver Neoplasms," and all citation indexes were chosen. Title, abstract, keywords, and other search terms are included in the "Subject" field search results. In addition, the time period is from the database's creation until November 30, 2025; the literary genre is restricted to treatises, conference papers, and reviews; and the language is only available in English. News stories, letters, communications, conference papers, information, and literature that do not fit the topic are among the exclusion criteria.

EndNote X9 and Excel 2010 were used to manage literature selection and data analysis, and literature citation frequency information in Web of Science citation reports was collected. VOSviewer 1.6.18 includes the country, institution, author, and keywords in each document and makes corresponding types of social network maps and time series maps, respectively. CiteSpace 6.1.R6 Select key-words and co-cited authors, set the screening threshold to "Top 5%," and make the corresponding graph. The number of instances is represented by the number of nodes in the graph. In VOSviewer's social network diagram, nodes belonging to distinct clusters are colored differently. With a darker node color indicating an earlier average publication year, the time average is used to generate the time series plan. CiteSpace nodes are colored and widened to indicate the quantity and time of occurrences. The incidence time increases with the darkness of the center color. The node that has a purple circle surrounding it signifies that its intermediary centrality is higher than 0.1, meaning it serves as a mediator between the other two nodes more frequently. The more connections, the greater the intermediary centrality, indicating that the analysis item represented by the node has an important influence in the field.

3. Result

3.1. Literature search results

There were 956 pieces of English literature that had been retrieved as of November 30, 2025. A total of 895 pieces of English literature, comprising 716 papers and 140 reviews, were acquired after duplicates and non-conforming literature were eliminated. The literature screening process is shown in **Figure 1**.

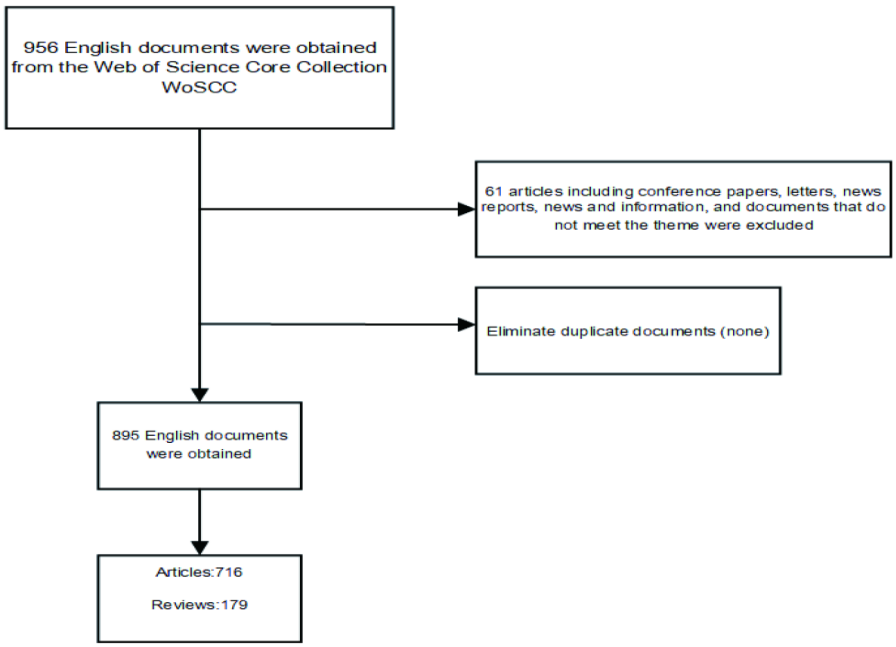

Figure 1. Flowchart for document screening.

3.2. Publication outputs and citation trends

The first article in the topic was published in 1991, and there were a total of 25 published before 2000. The number of publications per year is on the rise generally, reaching a peak in 2021. The change trend of the annual publication volume is shown in **Figure 2**.

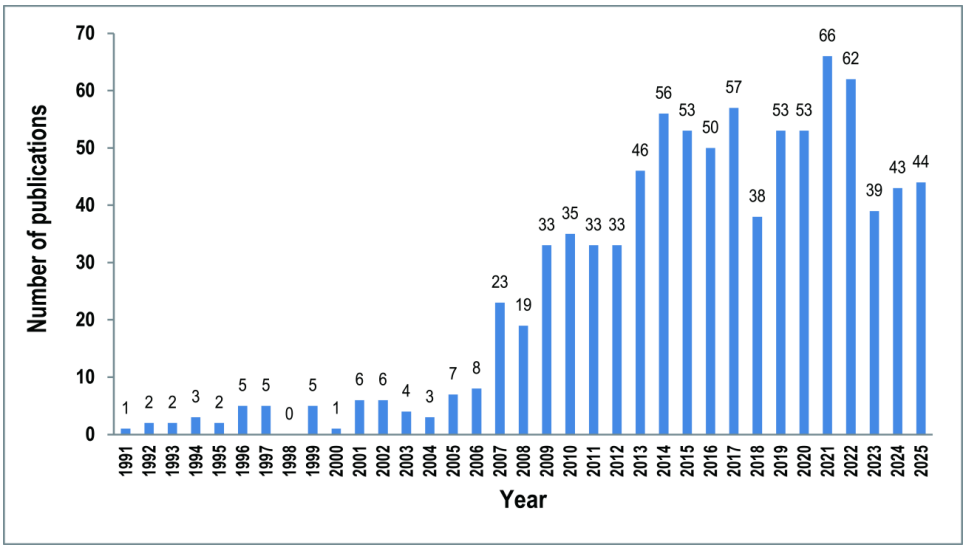

Figure 2. Annual number of publications on osteoporosis in selective internal radiation therapy research from 1991 to 2025.

The top three journals in terms of publication volume between 1991 and 2025 (**Table 1**) are the Journal of Vascular and Interventional Radiology (77 articles), the Cardiovascular and Interventional Radiology (58 articles) and the Journal of Gastrointestinal Oncology (24 articles). Nuclear medicine, interventional radiology, and cancer are the three professional publications that have published more than ten papers.

Table 1. Journals with more than 10 publications

Sources title	Output	% of 895	JIF (2024)
Journal of Vascular and Interventional Radiology	77	8.60	2.6
Cardiovascular And Interventional Radiology	58	6.48	2.9
Journal of Gastrointestinal Oncology	24	2.68	2.0
European Journal of Nuclear Medicine and Molecular Imaging	19	2.12	7.6
Nuclear Medicine Communications	15	1.68	1.3
Cancers	15	1.68	4.4
International Journal of Radiation Oncology Biology Physics	14	1.56	6.5
American Journal of Clinical Oncology Cancer Clinical Trials	14	1.56	1.8
European Radiology	13	1.45	4.7
Seminars In Interventional Radiolog	13	1.45	1.3
Medical Physics	12	1.34	3.2
Cancer Biotherapy and Radiopharmaceuticals	11	1.23	2.1
Frontiers In Oncology	11	1.23	3.8

The majority of the top 10 most cited publications (**Supplementary Table 1**) were written about phase III systemic therapy and dose, and they were all randomized controlled clinical trials, most were published after 2000.

Supplementary Table 1. The top 10 most cited works

No.	Title	First Author	Journal	Publication Year	Digital Object Identifier	Total Citations
1	Radioembolization for Hepatocellular Carcinoma Using Yttrium-90 Microspheres: A Comprehensive Report of Long-term Outcomes	Salem R	Gastroenterology	2010	10.1053/j.gastro.2009.09.006	802
2	Efficacy and safety of selective internal radiotherapy with yttrium-90 resin microspheres compared with sorafenib in locally advanced and inoperable hepatocellular carcinoma (SARAH): an open-label randomised controlled phase 3 trial	Vilgrain V	Lancet Oncology	2017	10.1016/S1470-2045(17)30683-6	638
3	Recommendations for radioembolization of hepatic malignancies using yttrium-90 microsphere brachytherapy: A consensus panel report from the Radioembolization Brachytherapy Oncology Consortium	Kennedy A	International Journal of Radiation Oncology Biology Physics	2007	10.1016/j.ijrobp.2006.11.060	544
4	Survival After Yttrium-90 Resin Microsphere Radioembolization of Hepatocellular Carcinoma Across Barcelona Clinic Liver Cancer Stages: A European Evaluation	Sangro B	Hepatology	2011	10.1002/hep.24451	519
5	Radioembolization Results in Longer Time-to-Progression and Reduced Toxicity Compared With Chemoembolization in Patients With Hepatocellular Carcinoma	Salem R	Gastroenterology	2011	10.1053/j.gastro.2010.10.049	510
6	Y90 Radioembolization Significantly Prolongs Time to Progression Compared With Chemoembolization in Patients With Hepatocellular Carcinoma	Salem R	Gastroenterology	2016	10.1053/j.gastro.2016.08.029	490

Supplementary Table 1 (Continued)

No.	Title	First Author	Journal	Publication Year	Digital Object Identifier	Total Citations
7	Randomised trial of SIR-Spheres® plus chemotherapy vs. chemotherapy alone for treating patients with liver metastases from primary large bowel cancer	Gray B	Annals of Oncology	2001	10.1023/A:1013569329846	402
8	Radioembolization with Yttrium-90 Glass Microspheres in Hepatocellular Carcinoma: European Experience on Safety and Long-Term Survival	Hilgard P	Hepatology	2010	10.1002/hep.23944	363
9	New therapies for hepatocellular carcinoma	Avila M.A.	Oncogene	2006	10.1038/sj.onc.1209550	333
10	Phase III Trial Comparing Protracted Intravenous Fluorouracil Infusion Alone or With Yttrium-90 Resin Microspheres Radioembolization for Liver-Limited Metastatic Colorectal Cancer Refractory to Standard Chemotherapy	Hendlisz,A	Journal Of Clinical Oncology	2020	10.1200/JCO.2010.28.5643	289

3.3. Number of publications issued by countries or regions

The top 10 countries in terms of publication volume are shown in **Table 2**. The United States (409 articles), Germany (82 articles), and England (58 articles) ranked in the top three. Among them, the United States was cited the most (14,799 times), followed by Germany (3,985 times) and Spain (3618 times).

Table 2. Top 10 countries with the most publications

Ranking	Country	Output	Total Citation
1	Usa	472	17481
2	Germany	88	4468
3	Italy	71	3237
4	England	63	3011
5	France	58	3061
6	Spain	54	4125
7	Australia	52	3436
8	Netherlands	49	1987
9	China	48	1052
10	Belgium	35	1892

3.4. Number of publications issued by research institutions

The top 10 research institutions in terms of the number of published papers are shown in **Table 3**. Among them, Northwestern University of the United States has the highest number of publications and citation frequency; Memorial Sloan Kettering Cancer Centre of the United States and Emory University of the United States rank second and third, respectively. Although the number of articles published by Hong Kong Chinese Hospital is small, it ranks 6th in the frequency of citations (17 articles, 1,089 citations).

Table 3. Top 10 institutions with the most publications

Ranking	Institution	Output	Total Citation
1	Northwestern Univ	86	5898
2	Mem Sloan Kettering Canc Ctr	29	532
3	Univ Texas Md Anderson Canc Ctr	25	1080
4	Emory Univ	23	722
5	Clin Univ Navarra	22	1185
6	Nw Mem Hosp	22	2522
7	Stanford Univ	22	669
8	Univ Med Ctr Utrecht	21	720
9	Singapore Gen Hosp	18	668
10	Chinese Univ Hong Kong	17	1089

3.5. Author's number of publications

The top 10 authors in the order of publication volume are shown in **Table 4**, all from the United States and Spain. The United States has the most authors, with nine. Salem R, the American author, ranked first in both the number of articles published and the number of citations (85 articles published and 6291 citations).

Table 4. Top 10 authors with the most publications

Ranking	Author	Country	Output	Total Citation
1	Salem,R	Usa	93	7343
2	Lewandowski,RJ	Usa	62	4697
3	Sangro,B	Spain	31	2295
4	Mulcahy,M	Usa	30	3744
5	Riaz,A	Usa	25	1917
6	Kulik,L	Usa	23	2732
7	Omary,RA	Usa	22	2938
8	Ryu,RK	Usa	21	2871
9	Sato,KT	Usa	19	2646
10	Gates,VL	Usa	19	1091

3.6. Author co-citation frequency ranking and co-citation network diagram

The authors with the top 10 citation frequencies are listed in **Supplementary Table 2**. Authors with greater co-citation frequencies have denser lines when combined with their co-cited social network (**Figure 3**). Nodes for Sangro B, Van Hazel G, Kennedy AS, Kennedy A, Riaz A, Lewandowski RJ, Salem R, Hendlisz A, Ho S, Jakobs TF, Kao YH, Van Cutsem E are surrounded by purple circles. The published papers are frequently utilized as a bridge to connect other publications, which has great cohesiveness and relevance in this subject, as seen by the eleven authors' median centrality of > 0.1.

Supplementary Table 2. The top 10 most cited authors

Ranking	Cited Author	Country	Centrality	Count
1	Salem,R	Usa	0.12	7343
2	Lewandowski,Rj	Usa	0.12	4697
3	Mulcahy,MF	Usa	0.01	3744
4	Omary,RA	Usa	0	2938
5	Ryu,RK	Usa	0.05	2871
6	Kulik,L	Usa	0.06	2732
7	Sato,KT	Usa	0.05	2646
8	Miller,F	Usa	0	2241
9	Sangro,B	Spain	0.23	2295
10	Atassi,B	Usa	0.01	1915

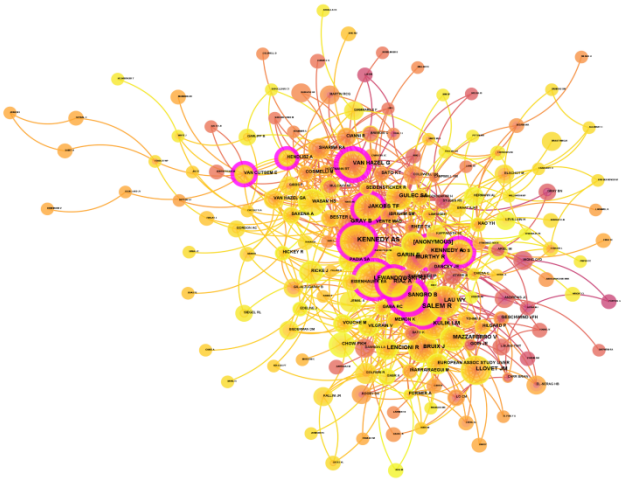

Figure 3. Co-citation analysis graph of authors (frequency ≥ 5).

3.7. Social network map and chronological map of a country or region

The social network map of countries or regions (**Figure 4a**) primarily divides countries or areas with cooperative interactions and a frequency of ≥ 5 times into five clusters: (1) The countries in red are those that work closely with Germany and the United States: Austria, Belgium, the United Kingdom, France, Italy, Spain, Switzerland, and Turkey. (2) The green areas are Australia, China, Singapore, South Korea, and close cooperation with the United States, Spain, Germany, and the United Kingdom. (3) The blue areas are Canada, Egypt, and Germany, which have close cooperation with Asian, European, and American countries. (4) The yellow area illustrates how the US, Japan, and Iran are all part of the same cluster and work closely with Australia as well as other Asian and European nations. (5) The purple area is the Netherlands, which has close cooperation with the United States, Germany, France, Belgium, and other countries.

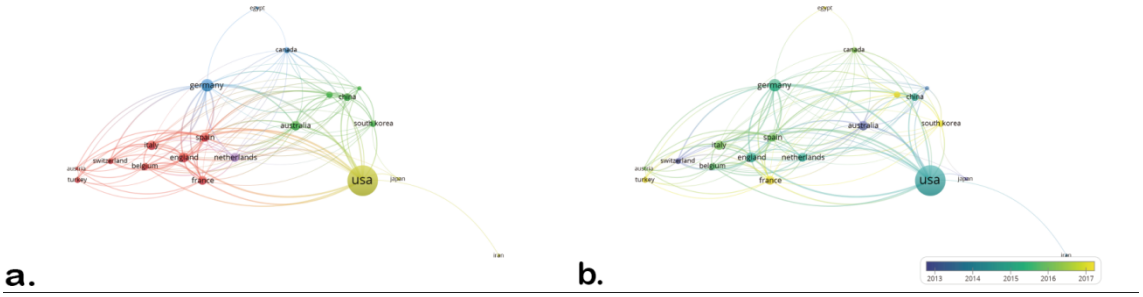

Figure 4. (a) Social networks of countries (frequency ≥ 5). (b) Sequence diagram of countries (frequency ≥ 5).

As shown in the time series diagram (**Figure 4b**), the average publication year of Australia, Switzerland, and other countries was earlier, around 2013; the average publication year of the United States, Germany, China, and other countries was around 2015; and France and Singapore have published a large number of articles since 2017.

3.8. The research institution social network map and sequence diagram

Eight clusters mostly comprise research institutions with a frequency of ≥ 5 times and collaborative relationships (**Figure 5**): (1) The red areas are: Northwestern University Memorial Hospital, Johns Hopkins University School of Medicine, University of New South Wales, etc. (2) The green areas are: the Chinese University of Hong Kong, Duke Medical School of the National University of Singapore, Hong Kong Sanatorium and Hospital, the National Cancer Institute of the United States, the National Cancer Center of Singapore, the University of Sydney, the University of Western Australia, etc. (3) The blue areas are: Emory University, Moffitt Cancer Center, Harvard Medical School, Mayo Medical Center, University of Texas MD Anderson Cancer Center, etc. (4) Yellow areas are: Institute of Barcelona, Spain; University of Hasetpe, Turkey; Munich City Hospital, Germany; University Hospital of Bologna, Italy; and University of Magdeburg, Germany. (5) Purple areas are: City of Hope National Medical Center, Stanford University, Utrecht University Medical Center in the Netherlands, Yonsei University in South Korea, etc. (6) The blue areas are: Christie NHS Foundation, Memorial Sloan Kettering Cancer Center, Seoul National University in South Korea, University of Rennes in France, Yale University School of Medicine, etc. (7) Orange areas are: the Netherlands Cancer Institute, the Technical University of Munich in Germany, the University of British Columbia in Canada, etc. (8) The brown areas are: North Carolina State University, Northwestern University, Imperial College London, the University of Navarra, Spain, and Wake Forest Baptist Comprehensive Cancer Center, USA.

Figure 5. (a) Social network of institutions (frequency ≥ 5). (b) Sequence diagram of institutions (frequency ≥ 5).

Northwestern Memorial Hospital and the Chinese University of Hong Kong published their works on average sooner, in 2012 or so. After 2001, some Chinese research institutes released publications, including the Chinese University of Hong Kong, among them releasing works somewhat sooner. In 2016, Northwestern University published a greater number of articles than any other university, with the highest frequency of citations. The Clinical School of the University of Navarra in Spain, the Duke Medical School of the National University of Singapore, and Harvard Medical School in the United States have all published related research recently.

3.9. The author's social network diagram and sequence diagram

The authors' social network map (**Figure 6a**) shows that the authors with a frequency of ≥5 times and with cooperative relationships can be divided into 7 clusters: (1) The red areas are Kim E, Kennedy AS, et al., and Lam MEH, Smits MLJ, et al., University Medical Center Utrecht, the Netherlands. (2) The green areas are: Salem R, Lewandowski RJ, Gates VL, etc., Northwestern University. (3) The blue areas are: Sangro B, University of Navarra, Spain; Pech MJ, University of Madburg, Germany; etc. (4) The yellow areas are: Garin E, University of Rennes, France; Sofocleous CT; Memorial Sloan Kettering Cancer Center, USA; etc. (5) The purple areas are all American scholars: Mulcahy MF from Northwestern University Cancer Center, Sato KT and Kulik L from Northwestern University, etc. (6) The blue area is for American scholars: Emory University Kokabi N, Schuster DM, Florida State University Camacho JC, Yale University Xing MZ, etc. (7) The orange area is for Australian scholars: Bester L. Meteling, Baerbel, Morris DL, etc.

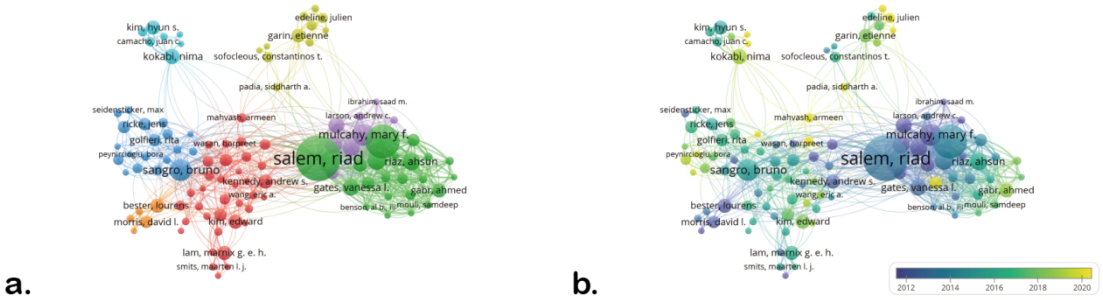

Figure 6. (a) Social network of authors (frequency ≥ 5). (b) Sequence diagram of authors (frequency ≥ 5).

The sequence diagram (**Figure 6b**) shows that the average publication year of American and Australian scholars is earlier, around 2012; the average publication year of German, Dutch, and Italian scholars was around 2016. Around 2014, Salem and Rida, the two American scholars with the greatest number of publications and frequency of citations, released their works. The countries with the most published papers after 2020 would be France and the United States.

3.10. Keywords

The keyword social network diagram (**Figure 7a**), which was created by merging synonym keywords and eliminating search terms, reveals that keywords that occur more than five times are primarily grouped into six clusters: The terms "hepatocellular carcinoma" and "treatment diagnosis" designate the primary uses of the red cluster, which is for hepatocellular carcinoma diagnosis and treatment. The purple cluster primarily consists of "yttrium 90 microspheres" and "internal radiation therapy," which stand in for adverse effects and complications of ^{90}Y-SIRT in the treatment of primary and secondary liver cancers. The green cluster, which is comprised of

the terms “hepatocellular carcinoma,” “chemoembolization,” and “safety,” primarily focuses on the safety of ^{90}Y-SIRT in the treatment of liver illnesses. (4) The yellow cluster is mainly a comprehensive treatment measure for liver metastasis of colorectal cancer, represented by “radiotherapy embolization” and “chemotherapy.” (5) The blue cluster is mainly the prognosis of primary and secondary liver malignancies after treatment, represented by “survival” and “transarterial radiation embolization.” (6) Cyan clustering is mainly for the prospect and analysis of ^{90}Y-SIRT, represented by “radiation embolization” and “trend”.

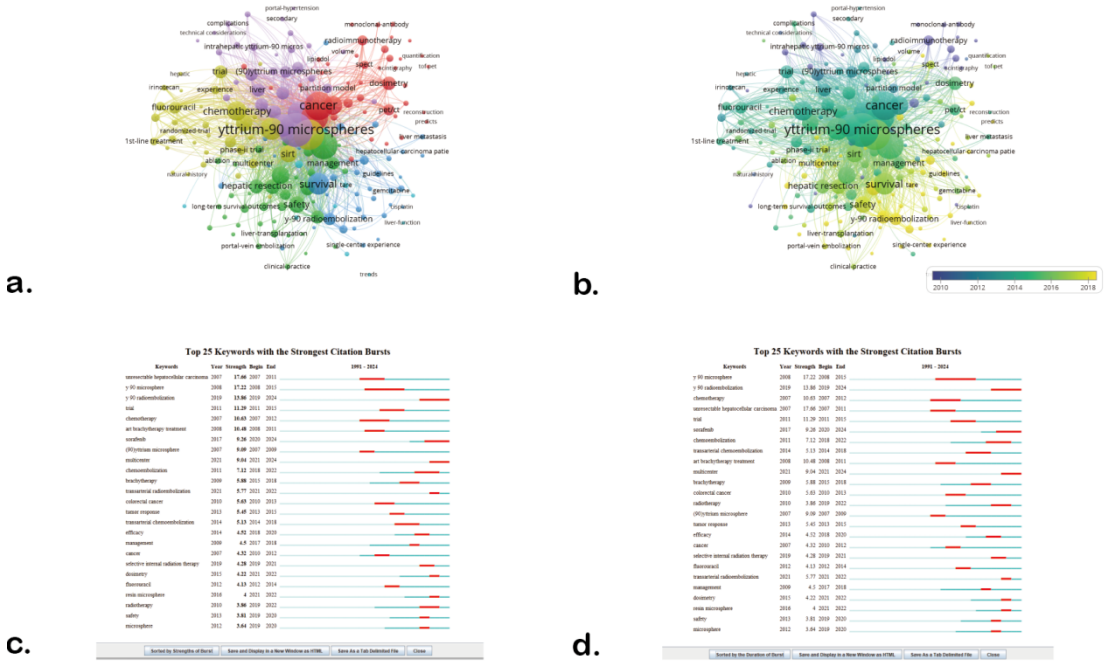

Figure 7. (a) Social network of keywords (frequency ≥ 5). (b) Sequence diagram of keywords (frequency ≥ 5). (c) Top 25 keywords with the strongest citation bursts. (d) Top 25 keywords with the during-time citation bursts.

The time series diagram shows (**Figure 7b**) that the average occurrence year of keywords in clusters (1), (2), and (6) are the earliest, around 2010; In the middle stage, clusters (1), (2), (3), and (4) occurred, and the average occurrence year was around 2014. Clustering (5) was published relatively late.

The term “emergence” (**Figure 7c, d**) refers to a spike in the frequency of occurrence of a particular keyword over a brief period of time, which may indicate future trends and hotspots in the area. “Start” and “stop,” among the top 25 emerging terms in the ^{90}Y-SIRT field, denote the beginning and ending times of the keyword as a frontier hot point, respectively. The most intensely emerging key phrase was “unresectable hepatocellular carcinoma.” “Yttrium-90 microspheres” emerged as the term with the longest longevity, lasting 8 years; subsequent keywords that have persisted after the emergence are “sorafenib,” “multicenter,” and “y-90 radioembolization.”

4. Discussion

Globally, colorectal and primary liver cancers are the most frequent malignant tumors. Primary liver cancer is the third most common cause of death and the sixth most common incidence worldwide, and colorectal cancer ranks second in death and third in incidence [11]. Furthermore, metastatic disease affects up to 50% of individuals

with colorectal cancer [12]. While colorectal cancer incidence is rising, mortality from the disease is decreasing. Of particular concern is the notable rise in cancer of colon, rectum and anus (CRA) incidence (up 1.7% year) among those in the 15–49 age range [13]. Research has demonstrated [14] that the median time to progression following regional therapy of Y90 is much prolonged and local tumour control is significantly enhanced compared with chemoembolization. In addition to posing challenges to the clinical treatment of liver malignancies, the evolving trends in the incidence and mortality of liver malignancies due to a variety of causes, along with the complexity of treatment options for both primary and metastatic liver cancer, also consistently encourage in-depth research on liver malignancy treatment. As a result, a thorough analysis and investigation of the available research on the application of yttrium-90 in the management of hepatic cancers must be done.

4.1. The use of Yttrium-90 in the treatment of liver malignancies is an important international research

According to the study's findings, eight of the top ten authors—Salem R, Lewandowski RJ, Mulcahy M, Kulik L, Ryu RK, Omary RA, Sato KT, and Sangro B, Spain—have the same number of publications and total citations. This suggests a strong scholarly impact from the United States and Spain, particularly with regard to the application of yttrium-90 selective internal radioembolization for the treatment of liver cancers. Salem R of Northwestern University in the United States not only has the highest number of publications and co-cited frequency, but also has the highest intermediate centre value and is closely connected with other authors. In addition to publishing clinical guidelines for Y90 microsphere brachytherapy and standardizing Yttrium-90 microsphere hepatic brachytherapy, Kennedy, A, Nag, S, and Salem, R [15] suggested a total of 14 class 2A consensus items in their 2007 study. It has been acknowledged and supported by experts of the International Nuclear Regulatory Commission, has significantly aided in the standardization and improvement of yttrium-90 microsphere hepatic brachytherapy, and is now the accepted worldwide mainstream consensus report on the use of yttrium-90 microsphere brachyembolization for the treatment of malignant liver tumors. Sangro B of the Clinical Research Center of the University of Navarra in Spain also demonstrated strong academic influence and strong cohesion in the field of brachyembolization of liver malignancy using yttrium-90 microspheres; it ranked fourth in the number of publications and ninth overall in the number of citations. Though its intermediate centricity was 0.23. He led the development of BCLC Prognostic Strategies and Treatment Recommendations, which focused on the key insights and expertise needed to make clinical decisions for individual patients while considering all the parameters that must be considered to provide personalized clinical management (2). "Treatment of Hepatocellular Carcinoma: An Update" provides latest information on hepatocellular cancer monitoring and diagnostic [16]. These articles all stress the significance of giving patients top-notch care, treating them at the most appropriate stage of their illness, and offering crucial advice regarding the use of yttrium-90 microspheres for brachyembolization as a hepatic malignancy treatment option.

4.2. Changes in keywords and hot trends in the use of Yttrium 90 in the treatment of liver malignant tumours

Unresectable liver cancers have received the greatest attention from researchers during the past ten years, based on the keywords with the highest intensity of emergence. Treatment should be tailored to the individual patient's condition, though, as primary and secondary liver cancers differ in their characteristics. Randomized trials have shown that patients with primary liver cancer who received ^{90}Y-SIRT had superior overall status, tolerance, tumor

response, and quality of life compared to those who received sorafenib [17]. Additionally, the cumulative incidence of first liver progression was significantly lower in the ^{90}Y-SIRT group than in the sorafenib group. This implies that in patients with primary liver cancer, ^{90}Y-SIRT may have a positive localized therapeutic effect. Relevant research and general agreement indicate that surgery is not usually the first line of treatment for patients with synchronous liver metastases of colorectal cancer, and that selective internal radiotherapy (SIRT) is still an option for "local treatment" in most cases [18–20].

Furthermore, alterations in hotspots within the field may also be reflected in variations in keywords. The term social network map indicates that high-quality prospective clinical studies have received a lot of attention lately [21–24]. The multi-center clinical trial of yttrium-90 radiation combined with chemotherapy and immunotherapy is the focus of current research in this sector, according to the combination of the term emergence intensity and this search query. High-quality, multi-center clinical studies of ^{90}Y-SIRT in conjunction with medication therapy and combined surgical resection after descending stage, according to the authors, may become the trend in this field going forward and continue to offer high-quality, empirically supported medical evidence for the all-encompassing treatment of malignant liver tumors.

Based on phase III systemic therapy and dose, the majority of the top 10 referenced papers are randomized controlled clinical studies. This is essentially in line with the previously identified research hotspots. The clinical results of patients treated with intra-arterial yttrium 90 microspheres for liver cancers were assessed in the first and second most cited prospective cohort clinical studies. The No 1 prospective single-center trial revealed that overall survival varied by stage, with patients with Child-Pugh A benefiting the most from ^{90}Y-SIRT for liver cancers, involving 291 individuals [25]. The second-ranked study also compared the efficacy of ^{90}Y-SIRT with oral sorafenib [17], and this randomized controlled prospective study showed that ^{90}Y-SIRT was significantly better tolerated than sorafenib and had significantly better local efficacy. The Expert Consensus report on yttrium 90 brachyembolization for the treatment of liver malignancy [15] was the third most frequently cited article. The panel suggested that in order to ensure safety and success, a treatment registry should be established with consistent reporting standards and that yttrium 90 microspheres should be managed by a multidisciplinary team. It is advised to conduct clinical trials to learn more about the effects and safety of Y90 microspheres.

Furthermore, pertinent clinical trials that have been published recently have demonstrated the safety and effectiveness of SIRT in the treatment of primary and secondary liver cancers with descending transformation, successfully obtaining a high rate of disease control [5,7,26–29].

4.3. The research status of Yttrium-90 in the treatment of liver malignant tumours in China

China has conducted clinical studies in the directions of SIRT combined with nabuliumab, SIRT combined with sorafenib, and anatomical hepatectomy after SIRT downphase, based on previous papers that highlight the significance of multidisciplinary teams in the treatment of yttrium-90 in the treatment of liver malignancies [4,30,31]. Furthermore, studies show that over 70% of liver cancer cases and deaths worldwide occur in Asia [32], that patients with liver cancer typically present later in life [33], and that clinical management practices and staging management systems differ in Asian and Western nations [34]. This implies that taking the lead in the future academic growth of the SIRT field in Asia is a potential prospect. Yet, the total number of published papers in China remains low, and no Chinese research institutions or researchers are listed among the top 10 research institutions or authors. This suggests that fewer teams and institutions in China are using yttrium 90 to treat liver malignant tumors, and

that there are also insufficient representative research teams and scientific research accomplishments in the global arena. Furthermore, although China's research institutes and researchers (in Beijing, Taiwan, and Hong Kong) exhibit clear regional distinctions, they have not yet developed a close academic network with the rest of the world.

4.4. Limitations of the study

Only the Web of Science core collection database was retrieved; other databases were not included in the statistics. Non-English literature was not included in the statistical analysis. The update of the cited frequency of included references may lead to fluctuations in the analysis results.

Throughout the conclusion, Yttrium 90 treatment for primary and secondary liver cancers is expanding throughout Asia and the rest of the world. This includes research on theory, technique, dosimetry, managing pulmonary shunts, and adverse events. The emphasis of research has steadily turned in recent years to high-quality, multi-center clinical trials with the combination of SIRT-targeted systemic therapy and hepatectomy after the descending stage. Furthermore, it is probably going to stay a significant study trend in this area.

5. Conclusion

This bibliometric study maps the evolving research landscape of ^{90}Y-SIRT for liver malignancies. The United States and Spain lead in output and influence, with keyword trends revealing a shift toward multicenter trials combining ^{90}Y-SIRT with systemic and surgical strategies. While Asia shows growing interest, its global impact remains limited. Future research will likely focus on integrated, multidisciplinary approaches to optimize liver cancer therapy.

Disclosure statement

The authors declare no conflict of interest.

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