ISSN 2618-1584 Vol. 4, Issue 11: 25-31, DOI: 10.25236/FMSR.2022.041105

Quantitative Analysis of Literature on Radiation-Induced Fibrosis Based on CNKI Database

Yankan Fu

School of Public Health, Jilin University, Changchun, Jilin, 13000, China
f18835550676@163.com

Abstract: *Objective To carried a bibliometric analysis of the related researches on radiation-induced fibrosis in China, and provide some theoretical support for the corresponding research in future clinical work. Methods Searching the literatures related to radiation-induced fibrosis published from the establishment of China journal full-text database to January 15, 2022 were searched, and conducting statistical analysis on the time, journals, institutions, authors, citations, keywords, and research content of their publications combined with Citespace. Results A total of 37 papers were included, of which the earliest was published in 2003; the papers were sourced from 29 journals and 44 institutions; 69 authors were included in the included papers; 3 were funded by funds, and the research content was mainly about radiation pulmonary fibrosis, ionizing radiation, epithelial-mesenchymal transition (emt), etc. Conclusion At present, there are few studies on radiation-induced fibrosis in our country, and the distribution of research journals is relatively scattered. But it is closely related to ionizing radiation and cells, and it is unknown whether it may become an emerging research hotspot. At present, more evidence-based medical exploration is needed.*

Keywords: *Bibliometric; radiation; fibrosis; China journal full-text database; Visual analysis; CiteSpace*

1. Introduction

With the development of modern medicine, radiation and interventional therapy have gradually become important means of tumor treatment and auxiliary operations. However, radiation induces inflammation or fibrosis in various organs[1], which is detrimental to normal cellular physiology and medical prognosis. Clinical practice shows that among several factors that seriously affect the clinical application of radiotherapy, the lethality of radiation fibrosis is an important one [2], such as pulmonary fibrosis[3]. Such radiation-induced lung injury often occurs in thoracic tumor radiotherapy and nuclear accidents that can cause acute whole body radiation[4]. It usually manifests as progressive dyspnea, deterioration of lung function, long-term bone marrow transplantation, etc., and eventually leads to respiratory failure, resulting in the death of the patient[5]. Therefore, focusing on the direction of radiation-induced fibrosis is conducive to alleviating and reducing the death caused by radiation fibrosis from the fundamental mechanism and microscopic level. Sorting out the current research status and development trend of this discipline has become the next step to guide clinical development. This paper refers to the relevant literature included in the full-text database of Chinese periodicals, and uses Citespace software to visualize it and conduct further statistical analysis, which can provide a certain reference value for the development of research in this field.

2. Materials and Methods

2.1. Literature sources

Using the "China Journal Full-text Database" as the literature search source, a quantitative analysis was carried out on the related research literature on "radiation-induced fibrosis" published before Febraary 25, 2022 after the establishment of the database. The retrieval time is January 2022.

2.2. Literature search strategy

Using the subject search function of the literature search source, the advanced search mode was

ISSN 2618-1584 Vol. 4, Issue 11: 25-31, DOI: 10.25236/FMSR.2022.041105

adopted, and the search formula was ("radiation-induced" or including "radiation") and all search terms including ("fibrosis") were in the precise search mode. The inclusion criteria of the literature were Chinese literature on radiation-induced fibrosis. Exclusion criteria: (1) "Information", "Abstract", "Interview" and other non-academic literature; (2) Literature whose full text cannot be obtained or has been published in multiple places. The types of documents were all journal documents, and a total of 47 documents were obtained. In accordance with the requirements of evidence-based medicine, those with a high degree of importance were included, and those who did not meet the requirements were excluded, and finally 37 literatures were obtained. The literature screening flowchart is shown in Figure 1.

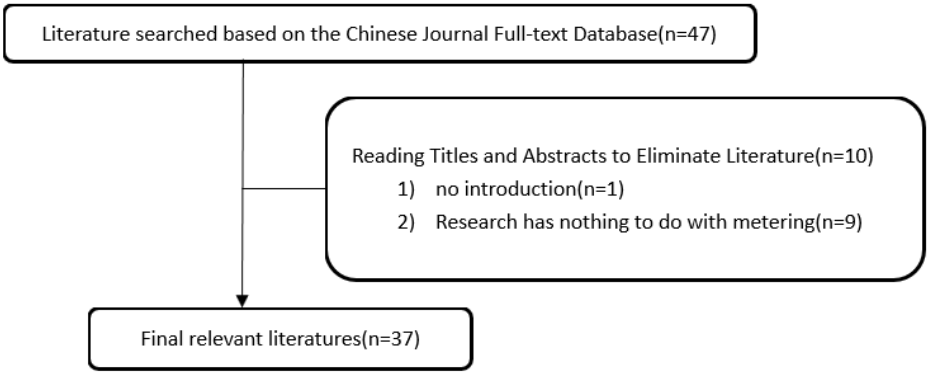

Figure 1: Literature screening flowchart

2.3. Statistical processing

Use charts and statistical tools to establish a database, organize the data and conduct correlation analysis on its statistical characteristics, and use frequency, frequency, percentage (%), composition ratio (%) and other aspects to describe. Including but not limited to publication time, journals, institutions, authors, keywords, etc.

3. Result

3.1. Number of papers and year of publication

A total of 37 valid literatures from 2003 to 2021 were retrieved in this study. Among them, 34 articles have been published in the past 10 years (2012-2021), accounting for 91.89% of the total literature, and the number of articles has increased year by year, as shown in Figure 2. The earliest published literature was published by Gu Qingyang, Academy of Military Medical Sciences of the Chinese People's Liberation Army, published in 2003, with the title of "BFGF's Regulatory Effect on Radiation-Induced Vascular Endothelial Cell Apoptosis and Its Signal Transduction Mechanism"[6].

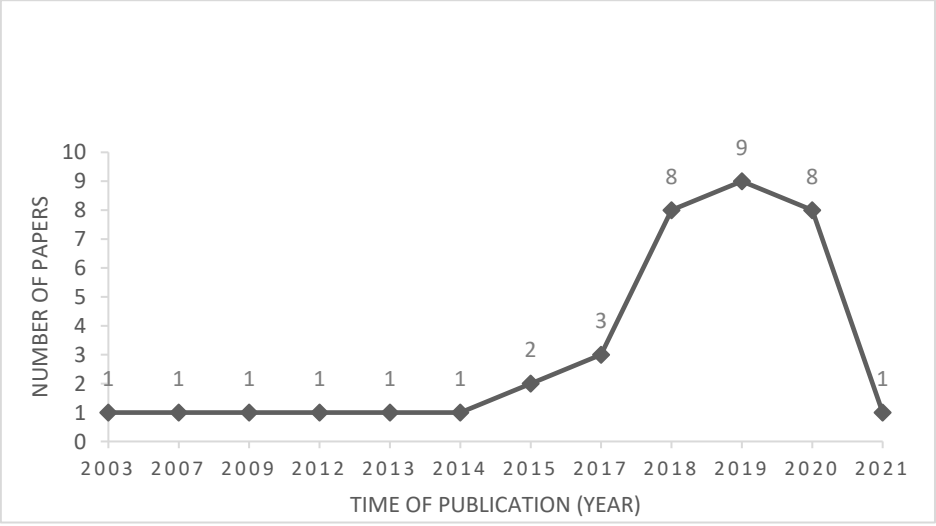

Figure 2: Year of publication

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3.2. Literature distribution

Of the 37 papers included in this study, 7 were from academic journals and 2 were from Chinese conferences. Among them, there are 14 papers published by master and doctoral degree. It can be seen that master's dissertation and doctoral dissertation are the main sources of this research literature, each accounting for 37.84% of the total literature.

3.3. Post structure

The number of publications published by an institution can reveal the geographical distribution of research, show the activity of the institution in scientific research, and evaluate the scientific research strength of the institution [7]. The 37 papers included in this study came from a total of 29 institutions. Among these institutions, 6 (20.7%) institutions have published 3 papers. The Academy of Military Medical Sciences, as the institution with the largest number of published papers, has a total of 6 papers. published.

Table 1: Top 10 publishing institutions

Numbering	Publisher	Number of Publications
1	Military Medical Academy	6
2	Anhui Medical University	4
3	Nanhua University	3
4	Southern Medical University	3
5	Jilin University	3
6	Guangdong Pharmaceutical University	3
7	Tianjin Medical University	2
8	Shihezi University	2
9	Qingdao University	2
10	Nanjing Medical University	2

3.4. Group of authors

As one of the important indicators to measure the scientific and technological output of researchers, the number of documents also plays a role in judging the core author group of a field [8]. Among the 37 papers included in this study, there are a total of 68 authors, of which 59 only published 1 paper; the author with the largest number of published papers is Gu Yongqing from the Academy of Military Medical Sciences, with 4 papers published, accounting for the total number of papers of 10.81%. Run Citespace, set the time span to 2003-2022, the time slice to 1 year, the node type to author, TOPN=50, and the remaining parameters to keep the default configuration. The number of nodes is 65, the number of connections is 134, and the number of authors is 0.644. The current network knowledge graph (see Figure 3). It can be seen from the way that the scholar with the largest number of nodes is Gu Yongqing of the Academy of Military Medical Sciences, and he participates in the cooperation of multiple author groups at the same time. The figure shows that various scholars have formed several major author sub-networks in the exchange and cooperation, such as the three author sub-networks participated by Gu Yongqing, the author sub-network headed by Zhou Cheng, and several sub-network structures participated by Zhang Xiumin, Wang Zibo, and Tian Yuxin. The figure also shows that there is a lack of communication and contact between several author groups. For example, the author group participated by Zhou Cheng and the three author groups participated by Gu Yongqing have less cooperation, while Zhang Xiumin, Wang Zibo, Tian Yuxin, and Wei Zhonghang each participated. The author groups are relatively independent, and lack of cooperation and exchanges with other author groups. In addition, there are many independent node scholars who have been screened out, such as Dong Zhuo, Wei Wei, Hu Die and other 25 people, accounting for 36.8%. The above all show that Chinese scholars have initially formed several large groups of scholars in the research of radiation-induced fibrosis, but there are still many independent scholars, and the awareness of cooperation and communication among the groups of scholars is weak. The existing cooperation is mostly intra-institutional cooperation and few Inter-institutional communication, the awareness of communication and cooperation between author groups and individual scholars needs to be improved urgently.

Price Law points out that the outstanding author in a certain research field publishes half of the literature in this field [9], and the calculation formula of outstanding author is $M_p=0.749\sqrt{N_{pmax}}$, where

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M_p represents the statistical The threshold of the number of articles by authors in this field as outstanding authors in the time period, and N_{pmax} is the highest number of papers published by authors in this field in the statistical time period. According to the statistical results, as of January 15, 2022, the author with the largest number of source documents in the Chinese Journal Full-text Database has published 3 papers, that is, N_{pmax}=3. At this time, the M_p is calculated as 1.30, and the integer represents all published papers in this field. Authors with a volume of 2 or more can be considered outstanding authors in the field. After statistics, there are 9 outstanding authors who meet the criteria for evaluation. They have published 19 papers in total, accounting for 51.35% of the total relevant literature. They basically conform to Price's Law, which the index of the total number of papers published by scientists whose number of papers is greater than m is equal to half of the total number of papers. The total number of papers is equal to half of the total number of papers. It can be seen that in the research of radiation-induced fibrosis in my country, the core author group has been initially formed. However, since the subject is still in the initial stage of development and the overall number of papers is insufficient, the conclusions still need to be verified in the future.

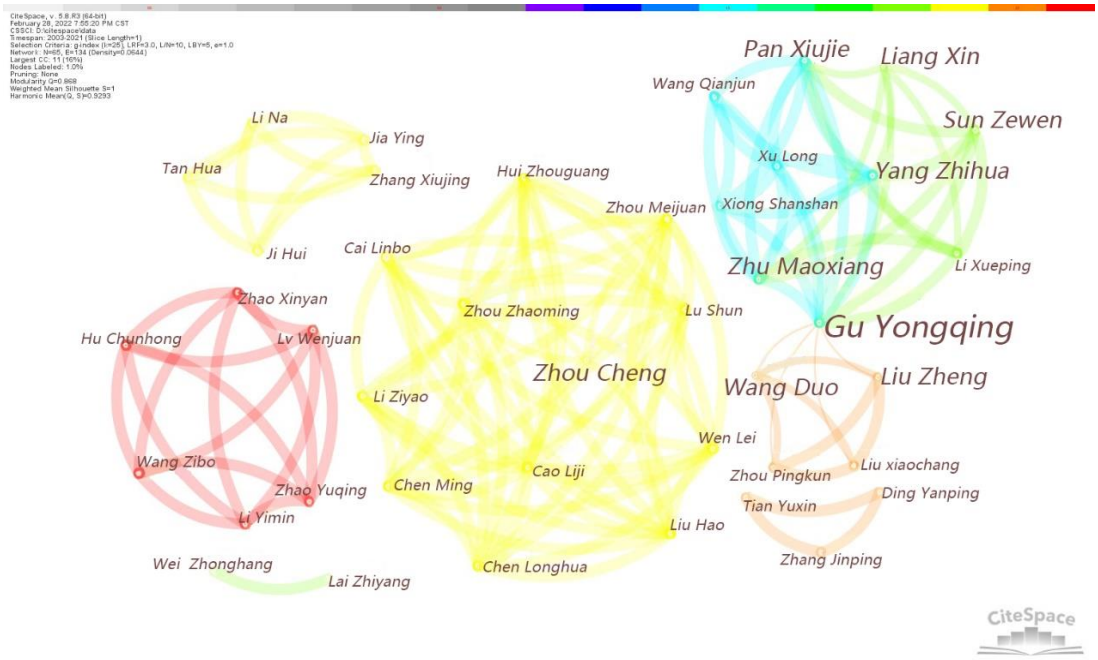

Figure 3: Author co-occurrence knowledge network map

3.5. Keyword Frequency, Co-occurrence and Evolution Analysis

The keywords of the literature included in this study are one of the important reference contents of the study. The top 10 high-frequency keywords about ionizing radiation-induced fibrosis related research are shown in Table 2.

Table 2: Ranking of high-frequency words in research literature on ionizing radiation-induced fibrosis

Numbering	high frequency word	frequency
1	radiation pulmonary fibrosis	15
2	ionizing radiation	12
3	Epithelial-mesenchymal transition	11
4	radiation lung injury	7
5	mouse	4
6	pulmonary fibrosis	3
7	apoptosis	3
8	reactive oxygen species	3
9	Radiation Therapy	2
10	Alveolar type II epithelial cells	2

Run Citespace, set the node type to keyword, and set other parameters to be the same as the author's analysis graph to get the keyword co-occurrence graph. It can be seen from the figure that the research hotspots in the field of radiation-induced fibrosis are relatively scattered, and the correlation between the

ISSN 2618-1584 Vol. 4, Issue 11: 25-31, DOI: 10.25236/FMSR.2022.041105

keywords is not close enough, indicating that in recent years, scholars have not cooperated strongly in research directions, lacking academic exchanges and communication, and research progress has been slow. To a certain extent, it reflects the lack of published papers in the field, and further research and exploration and wider exchanges and cooperation are still needed.

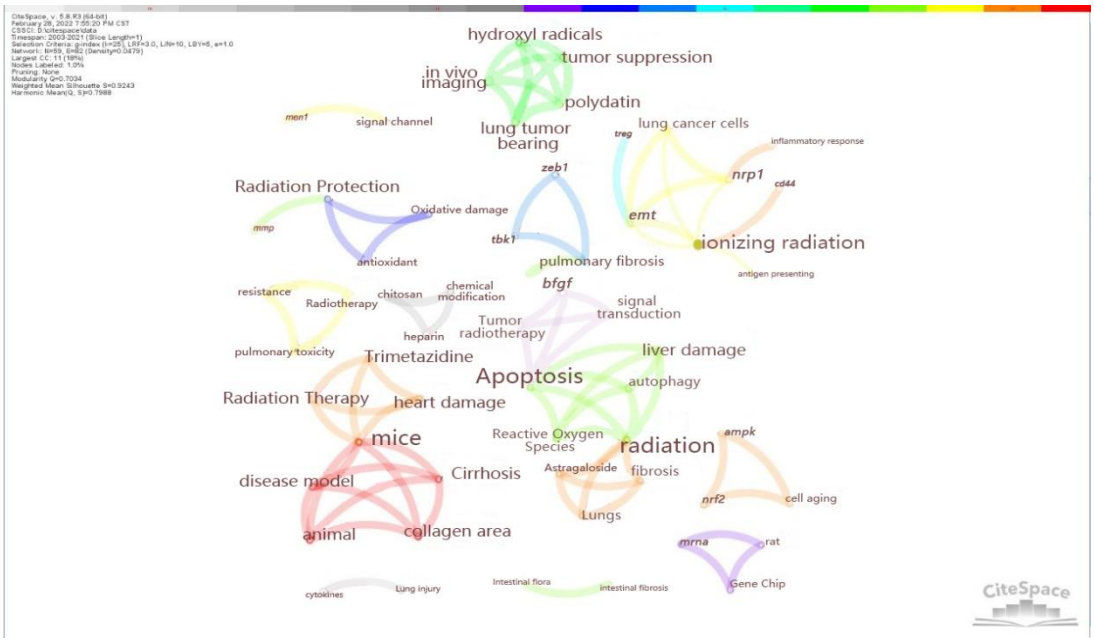

Figure 4: Keyword co-occurrence map

The keywords are expanded in the form of a time series map (Figure 5) to visually display the appearance time and interrelationships of keywords, which can well reflect the evolution process and trends of research hotspots in the field. Keywords are listed in the graph from left to right according to the time of their first appearance. The figure shows that the research began to develop slowly from 2003, and by 2013, the rapid growth of research hotspots began, including nrp1, nrf2, etc. in recent years.

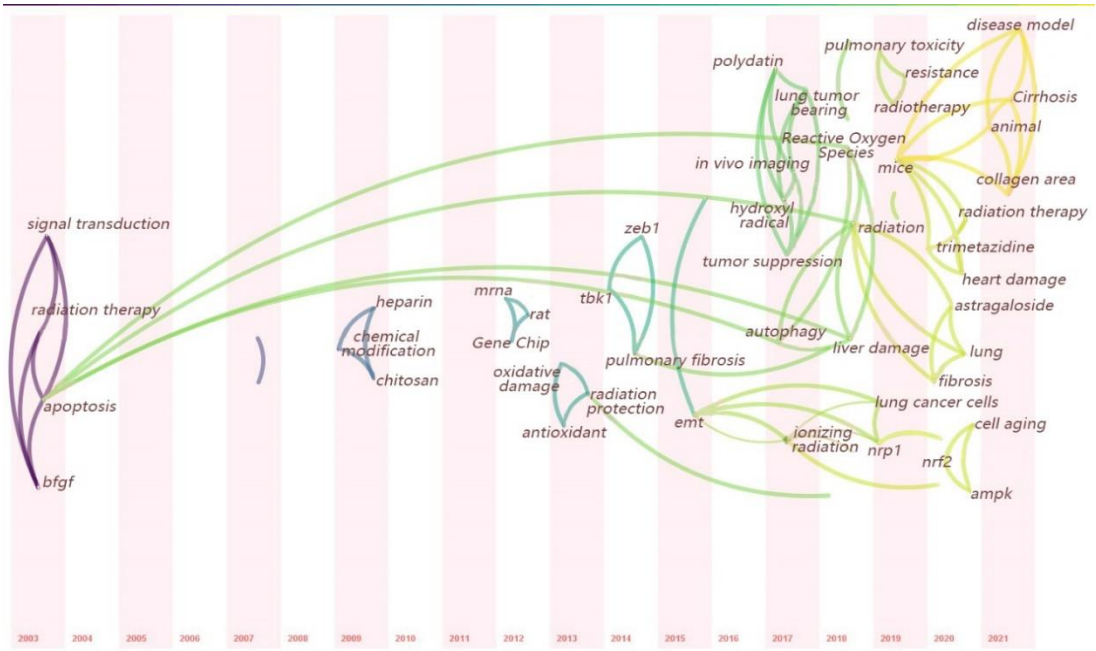

Figure 5: Keyword Time Zone Map

3.6. Emergent Word Analysis

The emergent detection function of Citespace obtains emergent words that can be used to predict the development trend of the field [10], which indicates the sudden increase of research interest and intensity

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in this field. The detection function is used to detect 6 mutation terms (Figure 6). Among them, the strongest mutation intensity was "epithelial-mesenchymal transition (emt)" (1.04), followed by "autophagy" (0.94). The hotspots that have emerged in recent years are "mice" (0.82) and "nrp1" (0.66), and they are still prominent. It is foreseeable that "mice" and "nrp1" may continue for a period of time or become a hot spot.

Figure 6: Analysis of the top 6 keywords

3.7. Fund Support

In the statistics of the literature, 10 papers (accounting for 29.7%) have been supported by different funds, including 9 national-level funding projects (accounting for 90.0%), and the funding funds are both the National Natural Science Foundation of China and provincial-level funding projects. 3 papers (accounting for 30.0%), funded by Tianjin Natural Science Foundation, Hebei Shijiazhuang Municipal Health Commission Scientific Research Project, and Guangdong Provincial Natural Science Foundation. 9 of the funded projects are distributed in the past ten years (2015-2021).), a distribution in 2005.

4. Discussion

The symbol of scientific research is the output of relevant literature, and the quantitative analysis of literature can help us review the research results and speculate the relevant development trends of future research. Judging from the publication time of the included studies, the research on radiation-induced fibrosis in my country was carried out earlier, but the start was slow, and the publications were scattered. published situation. However, since 2012, the development of literature publication has gradually accelerated, and literature publication is currently in the initial stage of development. The articles published in the past ten years account for 91.89% of the total literature included, indicating that in recent years, more and more scientific researchers have Noted the research direction of radiation-induced fibrosis and conducted extensive research on the topic.

According to the statistical data of the sources of research results, master's thesis and doctoral dissertation are the main sources of this research literature. The reason may be that most postgraduates are willing to choose this topic to carry out corresponding scientific research, and postgraduate majors are also closely related to this topic. The following sources are academic journals and Chinese conferences, which show that domestic research on this topic is becoming more and more sophisticated, and it also reflects that the strength and investment in the development of the field still needs to be improved. The publishing institutions of papers are relatively unbalanced in geographical distribution, among which research institutions are mainly concentrated in the economically developed provinces in the south, indicating that the above-mentioned institutions are more advanced and comprehensive in the topic of radiation-induced fibrosis. The institution is the Academy of Military Medical Sciences. It is hoped that in the future, more regions and more scientific research institutions in China will strengthen scientific research and cooperation on this topic.

In this study, most of the authors were scattered and did not form a stable academic team. Most researchers only published one academic document, among which Gu Yongqing from the Academy of Military Medical Sciences published the largest number of documents, accounting for 10.81% of the total literature. It can be concluded that the research direction of most researchers includes the topic of radiation-induced fibrosis, but the research on this topic is not deep enough, and only a small part of the research is carried out on this topic.

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From the research reference content, the more common high-frequency words are "radiation pulmonary fibrosis", "ionizing radiation", "epithelial-mesenchymal transition", and the frequencies of these three high-frequency words are all double digits, which can show The professionalism and comprehensiveness of the literature directly show that there is a relationship between radiation-induced fibrosis and ionizing radiation, most of which have epithelial-mesenchymal transition and radiation-induced pulmonary fibrosis. High-frequency keywords have played a guiding role in the research on this topic.

In recent years, the research enthusiasm for radiation-induced fibrosis in my country has continued to rise. The research journals are widely distributed, the research content covers a wide range, and the quality of the papers is generally high. However, the development of in-depth research and collaborative research is still lacking. It is hoped and foreseeable that the research on radiation-induced fibrosis will be intensified in the future, continue to carry out in-depth research in this field, and strengthen the promotion of a better scientific research cooperation atmosphere.

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