

•Literature Analysis•

Chinese literatures of radiation oncology covered by PubMed over the past five years

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[Abstract] Background and Objective: PubMed is generally acknowledged for its scientificity in literature coverage and authority of literature retrieval. In recent years, many studies have been published in China about radiation oncology. We aimed to investigate the literatures about radiation oncology in China covered by PubMed over the past five years. **Methods:** We collected primary data by searching the PubMed database using the related subject words. The collected data were analyzed and evaluated by bibliometric methods. **Results:** In the past five years, 550 articles by Chinese authors related to radiotherapy were indexed in PubMed. These articles were published in 160 journals among 26 Chinese provinces/cities. These articles mainly focused on radiation dose and computer-aided radiation therapy. Sixty-four articles were published by Chinese Journal of Cancer, which ranked the top. Forty-four articles were published by the International Journal of Radiation Oncology Biology Physics (IF=4.29), with the largest number among SCI journals. One hundred and sixteen articles from Guangdong Province were covered, accounting for 21.09%. **Conclusions:** Over the past five years, the discipline of radiation oncology has been greatly developed. The literatures mainly focus on clinical radiation oncology and their regional distribution is uneven.

Key words: Radiotherapy, PubMed, bibliometrics

Radiation oncology is a clinical interdisciplinary of radiology and oncology that mainly involves the studies of cancer treatment by radiation. Its study areas include mainly three aspects: radiation physics, radiation biology and clinical radiation oncology^[1]. In China, since the 1920s, the equipment used for radiation oncology has evolved from shallow X-ray treatment machine, deep X-ray treatment machine, cobalt-60 therapy unit to linear accelerator, and the radiation techniques have developed from conventional radiation therapy, stereotactic radiation therapy, three-dimensional conformal radiation therapy to intensity-modulated radiation therapy^[2]. In recent years, with the growth of computer science, electronics, medical imaging technology and molecular biology, China's radiation oncology has entered a new stage of rapid development and achieved great progresses in basic research and clinical application, and an increasing number of papers with continuously improved quality have been published in both domestic and foreign periodicals.

PubMed database is a biomedical literature retrieval system developed by the National Center for Biotechnology Information

(NCBI) affiliated to the US National Library of Medicine (<http://www.ncbi.nlm.nih.gov/pubmed>). The scientificity of its indexed journals and authority of literature retrieval has been well recognized by the medical community because of its rigorous and comprehensive involvement of nations, languages and subjects^[3]. In this study, the Chinese literatures of radiation oncology that have been included in the PubMed over past five years were selected and analyzed by bibliometric method to investigate the distribution of the articles, and the development and the international position of radiation oncology in China.

Materials and Methods

PubMed database was taken as the source of data and the retrieval date was March 20, 2009. 'Radiotherapy' was set as the subject heading according to the Medical Subject Headings (MeSH). The overall retrieval formula was ('Radiotherapy' [MeSH] AND China [Affiliation]) AND ('2004/01/01' [PDAT]: '2008/12/31' [PDAT]). Statistical analysis was conducted to investigate the subheadings, research fields, published journals, published time and the affiliations of the first authors in regional distribution.

Results

Between January 1, 2004 and December 31, 2008, a total of

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23 299 articles with subject heading 'Radiotherapy' was searched, among which 551 articles have the first author from China. After a paper published in January 2009 being removed, a total of 550 articles by the first author from Chinese institutes were included, accounting for 2.36%.

Distribution of the literatures in the MeSH tree table

MeSH is the controlled vocabulary used for indexing articles for MEDLINE/PubMed developed by the U.S. National Library of Medicine. The MeSH tree table is a grade classification of subject headings according to the disciplines^[4]. Subject heading 'Radiotherapy' has a total of 12 sub-sub-categories, and the distribution of the articles is shown in Table 1. There are 598 articles listed in the Table because 48 papers are cross-classified.

MeSH subject subheadings analysis

Under subject heading 'Radiotherapy', there are a total of 22 subheadings: administration and dosage, adverse effects, classification, complications, contraindications, economics, education, ethics; history, instrumentation, legislation and jurisprudence, manpower, methods, mortality, nursing, psychology, standards, statistics and numerical data, supply and distribution, trends, utilization, and veterinary. Combined use of MeSH headings and subheadings can not only improve the sensitivity and specificity of the retrieval, but also show the relationship among the articles^[5-6]. Retrieval was conducted using the above subheadings and the results were as follows: 184 articles for 'Methods'; 125 for 'adverse effects'; 36 for 'Instrumentation'; 13 for 'statistics and numerical data'; 7 for 'Standards'; 3 for 'Trends'; 2 for 'Mortality', 'Psychology', 'Utilization' each; and 1 for 'Economics'.

No article was retrieved using the remaining 12 subheadings. The reasons why the total number of the searched articles was only 375, might be that: (1) the subheadings listed in PubMed failed to cover all aspects of the subject headings, and (2) part of the articles failed to be classified in the corresponding subheadings.

Distribution of research fields

The number of articles focusing on clinical radiation oncology was 466, accounting for 84.73%. The number of articles on radiobiology and radiation physics was 49 and 31, accounting for 8.91% and 5.64%, respectively. The distribution ratio is shown in Figure 1.

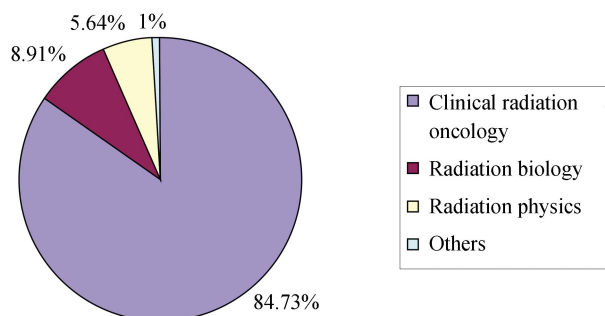


Figure 1 Research fields of the journals

Distribution of the journals

A total of 550 articles were published in 160 journals, including 135 foreign journals and 25 domestic journals. The top 10 journals (including joint rankings) are shown in Table 2 (PubMed abbreviations for journal names are used). They were nine domestic journals and eight foreign journals. The journal 'Chinese Journal of Cancer' published the largest number of the selected articles, accounting for 11.64%, followed by the 'Chinese Journal of Oncology' and 'International Journal of Radiation Oncology Biology Physics', accounting for 8.55% and 8.00%, respectively.

SCI journal impact factor analysis

The 'Science Citation Index' (SCI) was founded by the American Institute for Scientific Information in 1961. Among many factors used for evaluating the quality of academic journals, the Impact Factor (IF) is considered as the most objective quantitative indicator and is commonly used in the international academic community^[3]. According to the 2008 SCI Journal Impact Factor, the top ten SCI journals among the journals with the 550 selected articles are listed in Table 3, in

Table 1 Subject distribution in MeSH tree table

Tree Structures	Record count	Percentage(%)
Radiotherapy dosage	151	25.25
Radiotherapy, computer-Assisted	112	18.73
Radiotherapy, adjuvant	97	16.22
Brachytherapy	56	9.36
Whole-body irradiation	55	9.20
Radiotherapy, high-energy	44	7.36
Radiosurgery	43	7.19
Radioimmunotherapy	20	3.34
Cranial Irradiation	14	2.35
lymphatic irradiation	3	0.50
Hemibody irradiation	2	0.33
X-ray therapy	1	0.17
Total	598	100

Table 2 Distribution of the journals

Journals	Record count	Rankings	Percentage (%)
Ai Zheng	64	1	11.64
Zhonghua Zhong Liu Za Zhi	47	2	8.55
Int J Radiat Oncol Biol Phys	44	3	8.00
Nan Fang Yi Ke Da Xue Xue Bao/			
Di Yi Jun Yi Da Xue Xue Bao	27	4	4.91
Zhonghua Yi Xue Za Zhi	21	5	3.82
World J Gastroenterol	16	6	2.91
Radiother Oncol	12	7	2.18
Zhonghua Wai Ke Za Zhi	12	7	2.18
Clin Oncol (R Coll Radiol)	9	8	1.64
J Radiat Res (Tokyo)	9	8	1.64
Phys Med Biol	9	8	1.64
Chin Med J	8	9	1.45
Zhonghua Fu Chan Ke Za Zhi	8	9	1.45
Cancer	7	10	1.27
Med Phys	7	10	1.27
Zhongguo Shi Yan Xue Ye Xue Za Zhi	7	10	1.27
Zhongguo Zhong Yao Za Zhi	7	10	1.27

Table 3 IF of the journals

Journals	Record count	IF
Int J Radiat Oncol Biol Phys	44	4.290
Radiother Oncol	12	4.074
Clin Oncol (R Coll Radiol)	9	1.561
J Radiat Res (Tokyo)	9	1.260
Phys Med Biol	9	2.528
Chin Med J (Engl)	8	0.636
Cancer	7	1.425
Med Phys	7	3.198
J Neurosurg	6	1.990
Surg Neurol	6	1.112

which the ‘International Journal of Radiation Oncology Biology Physics’ published 44 papers, with IF of 4.290; the journal with the highest IF was ‘Journal of Clinical Oncology’ (15.484), but is not listed in the table because only three articles are included.

Distribution of publication time

The distribution of publication time is shown in Figure 2. A total of 139 articles were published in 2006 while 89 were retrieved in 2008.

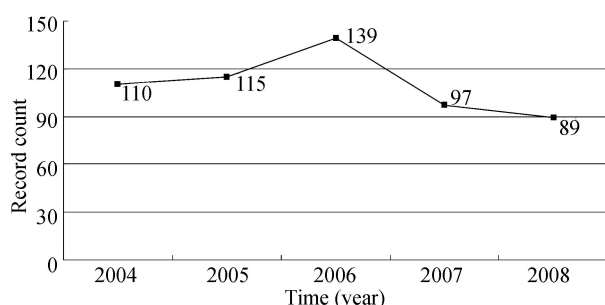


Figure 2 Distribution of publication time

Geographical distribution of the articles

The affiliations of the first author belonged to 26 provinces (municipalities and autonomous regions). The top ten provinces with a total number of articles of 472 (85.82%) are shown in Table 4. Guangdong Province is found to have the largest number of articles (116), accounting for 21.09%.

Statistics of the ‘Chinese Journal of Radiation Oncology’

‘Chinese Journal of Radiation Oncology’ is the only domestic journal in radiation oncology and has published a large number of outstanding articles. However, the journal is not indexed in PubMed. Therefore, the 765 articles published between January 1, 2004 and December 31, 2008 by this journal, were analyzed separately and the results were shown as follows.

Discussion

Scientific papers are the main manifestations of the outcome of scientific research. With China’s rapid development of radiation oncology, new achievement and development are being

Table 4 Geographic distribution of the literatures

Regions	Record count	Percentage (%)
Guangdong	116	21.09
Beijing	104	18.91
Shanghai	69	12.55
Hong Kong	61	11.09
Taiwan	32	5.82
Jiangsu	24	4.36
Sichuan	23	4.18
Shandong	19	3.45
Shanxi	14	2.55
Chongqing	10	1.82
Others	78	14.18
Total	550	100

Table 5 Research fields distribution of the articles in ‘Chinese Journal of Radiation Oncology’

Research fields	Record count	Percentage (%)
Clinical Radiation Oncology	498	65.1
Radiation Physics	163	21.3
Radiation Biology	93	12.2
Others	11	1.4
Total	765	100

Table 6 Geographic distribution of the articles in ‘Chinese Journal of Radiation Oncology’ (Top 10)

Regions	Record count	Percentage (%)	Rankings
Beijing	169	22.1	1
Shanghai	96	12.5	2
Shandong	85	11.1	3
Guangdong	61	8.0	4
Jiangsu	43	5.6	5
Hebei	40	5.2	6
Zhejiang	31	4.1	7
Hubei	30	3.9	8
Liaoning	23	3.0	9
Tianjin	21	2.7	10
Sichuan	21	2.7	10
Total	620	81.0	-

made increasingly. And having scientific articles published in international journals is the best way to demonstrate the new development in China’s radiation oncology, exchange with the overseas colleagues, and enhance our international status and influence in this field. Through this analysis, we can see that over the past five years, 550 articles in the area of radiation oncology by Chinese authors published in 160 domestic and foreign journals have been included in PubMed.

Among these journals, ‘Journal of Clinical Oncology’ (15.484) with 3 covered articles, has the highest IF (15.484). ‘International Journal of Radiation Oncology Biology Physics’ with 44 articles covered, ranks No. 1 among foreign journals, accounting for 8.00%. However, among the 23 299 articles retrieved using ‘Radiotherapy’ as the subject heading, there are only 550 papers published with the first authors from China, accounting for 2.36%. This is disproportionate with China as a large country, indicating that there is a great gap between China and developed countries in this field.

From the MeSH tree table, we can observe that the included articles mainly focused on ‘radiation dose’, ‘computer-aided radiotherapy’, ‘adjuvant radiotherapy’ and other aspects, which to a certain extent reflects the domestic research hotspots in the field of radiation therapy in recent years.

In the MeSH subheadings analysis, ‘method’, ‘side effects’, and so on are the main focus of the articles. The articles on clinical radiation oncology documents account for 84.73%, while the percentage of articles on the radiation physics and radiation biology is low. This indicates that China’s radiation oncology researches now mainly focus on clinical radiation oncology, and relatively less on radiation biology and radiation physics. The reasons may be as follows^[7]: (1) China has a great gap in human and material resources compared with developed countries, especially in radiation biology and radiation physics, and other infrastructure areas; (2) China has relatively less well-equipped radiation biology laboratories; (3) There is a shortage of professionals in radiation physics. We believe that the overall level of China’s cancer radiation therapy will be further improved with the development of radiation oncology.

‘Chinese Journal of Cancer’ and ‘Chinese Journal of Oncology’ have the largest coverage of articles, 111 in total, accounting for 20.18%, unfortunately, these two journals are not included in SCI. The number of articles in all the eight top foreign journals was only 105. ‘Chinese Journal of Cancer’ is one of the China’s core journals in oncology enjoying a certain reputation and influence both at home and abroad. In the past five years, its 64 articles were indexed in PubMed, accounting for 11.64%.

Over the past five years, PubMed included publications from 26 Chinese provinces, autonomous regions or municipalities. No related literature was recorded from the other 8 provinces, autonomous regions or municipalities, primarily in the western inland areas, which from one aspect reflected the uneven publication distribution of China’s radiation oncology: more in the economically developed regions, but less in the under-developed regions.

It is also noteworthy that ‘Chinese Journal of Radiation Oncology’ is the only domestic journal in radiation oncology and has published a large number of outstanding articles, but is not indexed in PubMed, making its published articles not included in the statistics. Therefore, its articles published between January 1, 2004 and December 31, 2008 were analyzed separately and compared with the China’s radiation oncology literature in

PubMed in the same period. Between 2004 and 2008, a total of 765 various types of articles were published in ‘Chinese Journal of Radiation Oncology’. According to the MeSH tree sub-sub-categories, the most frequently used one in a total of 118 (15.4%) articles in ‘Chinese Journal of Radiation Oncology’ was ‘radiation dose’ (including dose, dosimetry, radiation dose, dose distribution, dose calculation). In terms of research fields, most articles (498 or 21.3%) were about clinical radiation oncology, followed by radiation physics (163 or 21.3%) and radiation biology (93 or 12.2%). Most of the articles were published in 2005 and 2006, 177 and 162, respectively. As to the regional distribution, the five provinces and municipalities had the largest number of articles, including Beijing (169), Shanghai (96), Shandong (85), Guangdong (61) and Jiangsu (43). Thus, we can see that in the past five years the number of articles on radiation oncology in China covered by PubMed is highly consistent with that in the domestic journal ‘Chinese Journal of Radiation Oncology’ in the distributions of subject heading, research field, publication time and geography. This fully shows that the analysis results of this study can disclose the current status of China’s radiation oncology research.

In summary, this statistical analysis gives an overview of China’s radiation oncology literatures indexed in PubMed over the past five years. We believe, with the growth of radiation therapy and technology, more studies about basic theory and clinical practice in radiation oncology will be carried out in China, and consequently more articles of high quality will be published both at home and abroad, especially in SCI journals.

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