Bibliometric Analysis of Nanotechnology Applied in Colon Cancer Screening and Therapy from 2002 to 2011

[1]**Xiao-Chun Qiu;** [2]**Jack Jia;** and **Qian Liu**[3]

[1]Information Center School of Medicine, Shanghai University, 200025 Shanghai, China
[2]Sbarro Institute for Cancer Research and Molecular Medicine, Center of Biotechnology, College of Science and Technology, Temple University
[3]Tianjin Lung Cancer Institute, Tianjin Medical University General Hospital, Tianjin, 300054, China

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Correspondent Author:
Qian Liu,
Email:76kevin@tongji.edu.cn

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Nano-medicine, Bibliometric analysis, Gastrointestinal Cancer

ABSTRACT

Background: Colon cancer is one of the most difficult diseases; the development of nanotechnology and nanomedicine has provided a new way to overcome colon cancer. Nanotechnology can largely improve the occurrence of tumor screening and diagnosis. Nano-drugs in tumor targeted therapy caused lots of attention. This article aim to do a bibliometric analysis of nanotechnology used in colon cancer screening and therapy, and provides an overview of the full research field. Method: Literature search was performed through the use of PubMed search engines with the following MeSH terms: nanotechnology, nanomedicine, and colon cancer or colon neoplasms. The article search was concentrated on developments from 2002 to 2011. By using Gopubmed website, we analyzed the numbers of publications, countries of origin, author count, Frequency of MeSH subject. Results**:** United States is the leader in global nano colon cancer research, accounting for more than half of the total number of articles, followed by China, Iran. Based on the study of the frequency of the appearance of those MeSH terms, subjects such as, microscopy, colonoscopy and early detection of cancer are attractive to researcher in this field. Conclusion: This study demonstrating that research in this field is developing fast. More scientists are becoming interested in this research area, as evident in the breakthroughs achieved in recent years. Research on nanoparticle and colon cancer apoptosis /colonoscopy is most discussed recently.

التحليل الببليومتري لتطبيق النانوتكنولوجيا في فحص وعلاج سرطان الجهاز الهضمي من 2002 إلى2011

[1]**كياوشون كيو،** [2]**جاك جيا،** و [3]**قيان ليو**

[1]مركز معلومات مدرسة الطب، جامعة شينغهاي، 200025 شينغهاي، الصين
[2]مركز الببلومتر معهد بحوث السرطان والطب الجزيئي، كلية علوم التكنولوجيا، جامعة تيمبلي، الصين
[3]معهد سرطان القولون جامعة تيانجين الطبية، 300054 تيانجين ، الصين

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بريد الكتروني:
76kevin@tongji.edu.cn

المُستلخص

أوجدت إبتكارارت النانوتكنولوجيا خلال العقد المنصرف مجموعة متنوعة من وسائل الاستشعاروالإستنساخ والوسائل المتعلقة ببحوث علاج سرطان الحهاز الهضمي. من بين هذه الوسائل جهازالنانوجزيئي الدائري والذي يعتبر جهازاً فعالاً في تجميع الجزيئات وذات القدرة على التحكم الإنتقائي في جزيئات الورم وإيصال الأدوية والعقاقير والتمكين من الكشف عن طريق مُستقبلات الخَلايا الضوئية والأنابيب الجزيئية الكربونية، وتشكل هكذا الوسائل والأدوات دلالات واضحة على التوسع والتطور في توظيف النانوتكنولوجيا في التطبيقات الطبية. إتبع في هذه الدراسة منهج الدراسات المسحية والمنشورة في مواقع البحوث الطبية بشبكة الإنترنيت خلال السنوات من 2002 إلي 2011 وذلك عبر مداخل بحث منها النانوتكنولوجيا والطب الجزيئي والأورام السرطانية، ومن ثم تمت دراسة وتحليل بيانات باستخدام (Gopubmed website) من حيث عدد المنشورات ، دول المنشأ ، وقياسات الباحثين وتوالي البحوث. أظهرت نتائج الدراسة أسبقة الولايات المتحدة في دراسات النانو إذ نشر منها أكثر من نصف البحوث المرصودة، تليها اليابان ثم ألمانيا وفرنسا والصين و الهند. واستناداً على تقييم توالي البحوث المرصودة يستخلص تطور وسائل العلاج الجزيئي والتطبيب بالجينات والكشف عن الأورام بمُستقبلات الخَلايا الضوئية والأنابيب الجزيئية الكربونية. يشير ملخص الدراسة إلى التزايد المُطَرِد في إحصاء العلماء والباحثين المُهتمين وبالتالي إرتقاء وتطور البحوث في تطبيقات النانوتكنولوجيا في معالجات أورام الأدواء السرطان، كما يتضح من سجل المنجزات التي قد تحققت خلال السنوات الأخيرة (2002-2011).

الكلمات الدالة

نانو الطب، تحليل الببليومترية، سرطان الجهاز الهضمي

Introduction

(1) Nanotechnology

Since nanotechnology has been introduced in 1986, it has brought medicine to a new field (Sahoo, 2007). The size of the particle is the advantage of nanotechnology, which is smaller than human cells. This kind of particle can went though blood vessels, blood-brain barrier, et al (Bertrand, 2014). These advantage enable this technology can be used in many parts of medicine, such as prevention and early and reliable diagnosis and treatment of diseases (Thomas, 2011). Nanotechnology can monitor, control, construct, defend, repair, and improve all human biological systems at the molecular level by using engineered devices and nanostructures to achieve medical benefits (Caruso, 2012).

Cancer has been a difficult problem for a long time, but the diagnosis and therapy efficacy are still unsatisfying. Nano-oncology is widely used in tumor prevention, diagnosis and therapy (Farokhzad, 2009). Nano-oncology has developed to be a useful molecule iconography tools, which can observe the living cells in real time, and favorable for early and effective diagnosis and treatment of cancer (Huang, 2011) . Nano-oncology can be used for drug delivery, nanoparticles seeping though high permeability tumor vessels into tumor tissue, and targeted attract tumor (Mclntyre, 2012, Wen, 2014). Nano target delivery improved drug treatment efficacy cut off drug dosage and reduce side effects (Thakor, 2013). In cancer diagnosis, there are nano bio-chip can analysis a single biochemical molecular, gold nanoparticles used as contrast agents in vivo monitoring specific markers of cancer cells, nano–device collect protein to distinguish between normal and cancer organizations, as well as nano-magnetic resonance angiography contrast media (Krishnan, 2014). In 2004, American has started the "nano-oncology technology research, and build nano-oncology committee, meanwhile, National Intisitute of Health has fund nano-oncology research center and the journal of nano-medicine (Ensign, 2014). Nano-oncology has caused lots of attention in the research field of medicine (Matsumura, 2014).

(2) Current Development of Nanotechnology Applications in Colon Cancer

Nanotechnology also has been used in the screening, diagnosis and therapy of colon cancer(Bombelli,2014). Colonoscopy is a widely used colonoscopy screening method, the occurrence of colonoscopy depend on lots of factors, such as, the speed of examination and the experience of physicians, researchers engaged in improve the occurrence of colonoscopy, because the early detection of tumor is essential for colon cancer therapy (Leung, 2013). Nanotechnology has been used in colonoscopy to increase the occurrence, nanoparticles marked with fluorescent material binding to cancer cells, can distinguish cancer cells from normal ones (Siegel, 2013). Nanotechnology used in colonoscopy improved the occurrence of early colon cancer screening. Arbon nanoparticles effectively helped with cancer tissue location in laparoscopic colonic cancer surgery (Leung, 2014) and guidance for lymph nodes dissection. Also, in target drug therapy, nano drug carriers have been used to deliver medication that kills colon cancer with more precision and less pain (Boland, 2012).

Data and Methodology

Literature search was performed by using PubMed search engines with the following MeSH terms: nanotechnology, nanomedicine, colon cancer and Colonic Neoplasms. The expression terms were "nanotechnology or nanomedicine" and "colon cancer or Colonic Neoplasms". The article search was concentrated on developments during the 10-year period from 2002 to 2011. By using Gopubmed.com, we collected 250 articles in over 140 medical magazines from more than 30 countries. Then, we conducted a series of analyses on countries of origin, author counts, Frequency of MeSH subject in gopubmed website (www.gopubmed.com). After collecting data from gopubmed website.

Results and Discussion

(1) Publication Output

The published articles from 2002 to 2011 are present in Figure 1. The annual number of articles increased from 1 in 2002 to 39 in 2011. During the study period, the cumulative number of papers consistently increased (Figure 1). Based on the power model, we can predict the increasing trend in the number of publications and the speed of annual growth. The increase trend may keep in 2012 and further future.

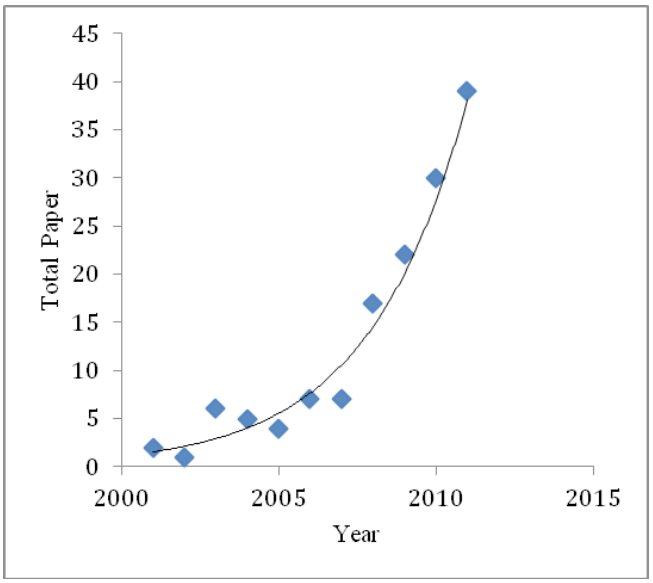

Figure1: Number of Journals with the Scope of Nano-colon Cancer

(2) Publication Performance: Countries, Journals, and Authors

The top 10 countries or territories were ranked based on the number of publications presented in Figure 2. US is the top productive country, over twice higher than other counties, followed by China, Iran, Taiwan, South Korea, It is considerable that there are six Asia countries, but only three Europe countries. These 10 countries accounted for nearly 90% of global publications. No African or Latin American countries are in the top 10 productive countries.

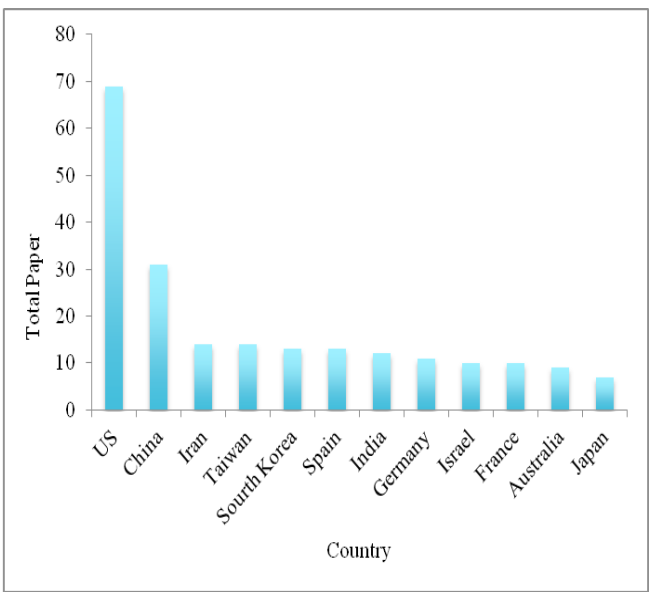

Figure2: Top 10 Countries or Territories of the Number of Publications on Nano-Colon Cancer

Figure 3 illustrates that annual publications were printed on more journals during the last 10-year period, the number increasing from 38 in 2002 to 204 in 2011. The number of journals was almost the same in 2008 and 2009, the growth suspended in 2009 which could be a result of the global economic recession or a decrease in audience interest(Leach, 2012). Considering the growing number of journals publishing articles on the use of nanotechnology in colon cancer, we think that this scientific field will generate even more interest in the near future.

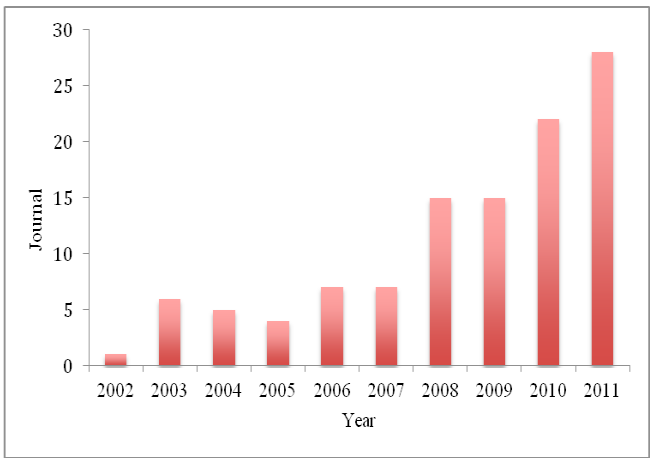

Figure 3:Trends in the Number of Nano-Colon Cancer Related Journals in the Past Ten Years

In 2002, only 6 researchers were involved; but in 2011, a total of 294 researchers published their scientific findings in numerous medical journals (see, Figure 1). Figure 4 illustrates the rising trend in research interest. The developing trend shows that this research field attracted these researchers.

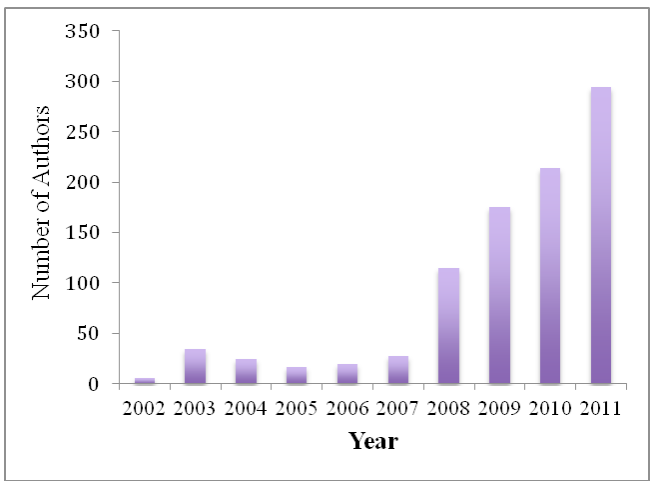

Figure 4: Trends in the Number of Nano-colon Cancer Authors in the Past Ten Years

(3) Analysis of MeSH subject and Future Research Trends

MeSH subject that appeared in the articles referring to the application of nanotechnology in colon cancer from 2002 to 2011 can be calculated and ranked by gopubmed website, but lots of MeSH words on the top of MeSH tree were also included, such as Human, Nanotechnology, Neoplasms, Protein, Tissues et al. This kind of words is useless to our analysis. Such MeSH were delected after careful examination, finally, 18 selected keywords are listed in figure 5.

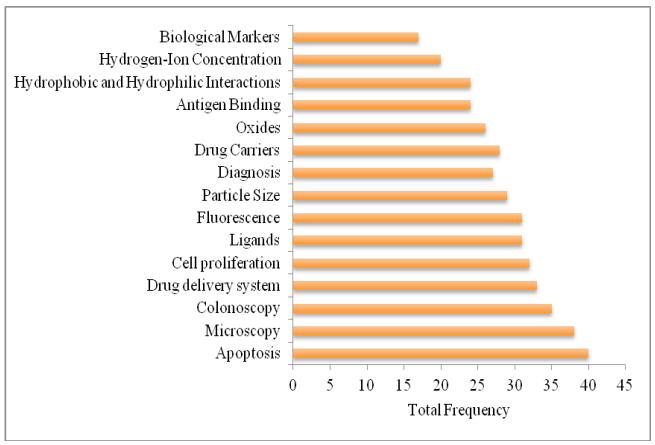

Figure 5: Analysis Top Key Words of Publications

From Figure 5, we can identify that "apoptosis", "drug delivery system"(Ness, 2012), "microscopy", and "colonoscopy" (Leung, 2013), Drug delivery are the five most frequently used keywords; thus, we can approximate that the overall research focus during the 10-year study period. Other significant research topics are "fluorescence" (Ramsay ,2013) and "Apoptosis" (Tejaswi, 2013) results were reported in figure 3 (see, figure 3) . Based on the figure, we can determine the annual frequency of the MeSH words used and the total number of times they appeared during the 10-year study period. A total of 252 articles, with records that included keywords in the PubMed database between 2002 and 2011, were calculated in our analysis.

Figure 6 provides information on the chronological performance of each keyword. The appearance of the top five keywords increases every year, which means that research on those subjects is intensified and continuous. Moreover, Figure 6 reveals that some keywords related to imaging or diagnostic methods, such as "fluorescence" "tumor marker", "microscopy", "and "colonoscopy" (Bak, 2013) also appear more frequently in the articles. The use of new techniques such as Hydrogen-iron Concentration (Ji, 2010) and hydrophobic and hydrophilic interactions (Arvizo, 2012)has also attracted the attention of scientists. The frequency of this key words illustrate a research trend in this field, whereas nanoparticles used in colonoscopy (Leung, 2012), fluorescence technology accompany with nanotechnology has been widely used in this research field (Garnier, 2014), the role of Nanoparticles in tunor cell apoptosis is other hot topic(Thompson, 2014).

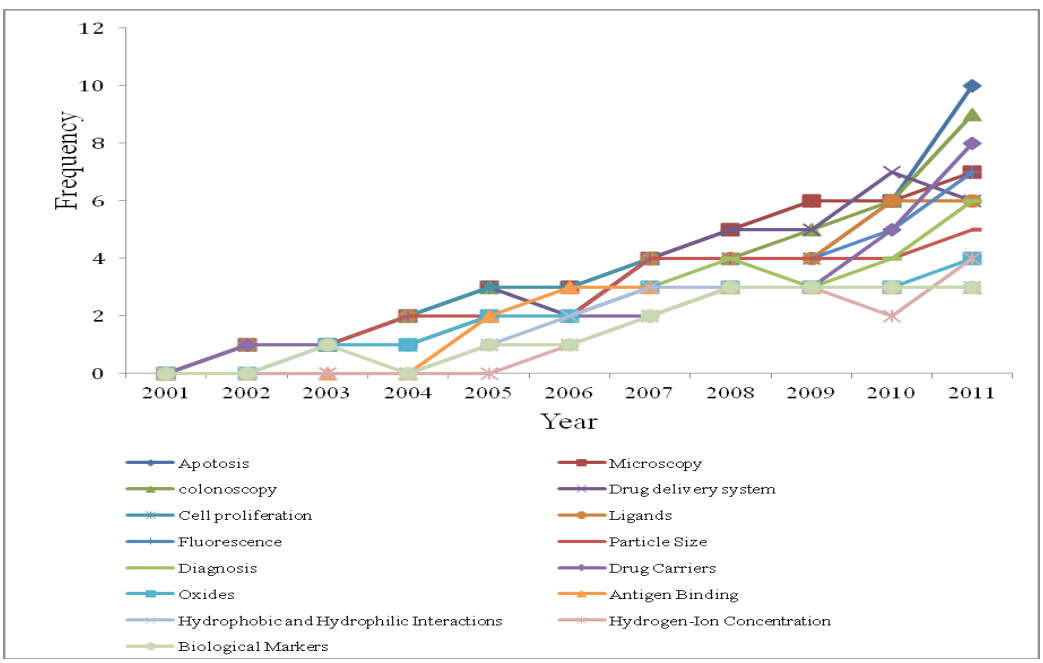

Figure 6: Trends in frequency of top key words in the past ten years.

Conclusion

In this study, the global scientific research production in the application of nanotechnology in colon cancer from 2002 to 2011was quantitatively characterized. The results indicate the cumulative number of papers was increasing during the 10-year study period and to be increasing in the coming future. Researchers from North America, Asia made the largest contribution to the publications. The US is the top-rank country in research output. And China ranked second in the number of papers published. A substantial amount of research has been carried out on apoptosis, colonoscopy, and so on. The analysis of keywords demonstrates the hot point in this research field is nanoparticle and colon cancer apoptosis /colonoscopy. Hopefully, this paper will contribute in mapping out the future direction of nanotechnology as applied in colon cancer.

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