



# Xiaomao Guo: help cancer patients with precision medicine

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## Expert's introduction

Xiaomao Guo, director of Fudan University Shanghai Cancer Center (FUSCC), director of Shanghai Proton and Heavy Ion Hospital (SPHIC, also Proton and Heavy Ion Center of FUSCC), professor, chief physician, doctoral tutor, and Shanghai Outstanding Discipline Leader. He is mainly engaged in the radiation therapy of breast and abdominal tumors, especially in radiotherapy and multidisciplinary treatment of breast cancer, prostate cancer, malignant lymphoma, and other tumors. Currently he serves as the vice chairman of Chinese Anti-Cancer Association (CACA), elected chairman of CACA Professional Committee of Radiation Therapy, and vice chairman of Chinese Society for Clinical Oncologists. He is the principal investigator of many scientific research projects funded by “863” Program, National Natural Science Foundation of China. He was the winner of the Ministry of Education Science and Technology Progress Prize (first class). He has published over 60 scientific articles in top oncology journals. Also, he has trained a number of masters and doctors. As a hospital manager, he actively promotes the reform and meticulous management of hospital disciplines by introducing advanced management concepts such as multidisciplinary treatment models and ambulatory treatment, optimizing service procedures, and continuously improving the quality of medical services. In 2013, he was awarded the honorable title of “Hua-Ren Cup—the Most Leadership of Chinese Hospital Directors”.

As the first medical institution in China equipped with proton & heavy ion radiotherapy equipment, SPHIC (also Proton & Heavy Ion Center of FUSCC) has made remarkable achievements since its official opening on May 8, 2015. A total of 1,263 patients have been admitted, including 654 cases of head and neck tumors, 205 cases of thoracic tumors, and 404 cases of abdominal and pelvic tumors and other tumors. Among these 1,263 patients, 1,154 (91.4%) were treated with heavy ion radiotherapy alone or heavy ion plus proton therapy. It took the center 19 months to treat its 500th patient (in December 2016) and 11 months to hospitalize the 1000th patient (in October 2017). Today,

the annual patient volume at SPHIC is close to those in similar international top centers that have been operating over 5 years. At present, the center can treat nearly 40 types of tumors, and the number of standard operating procedures of particle therapy has reached 56, covering the top 10 tumors in China.

As the director of both FUSCC and SPHIC, Dr. Guo has long been known as an outstanding hospital manager and an excellent doctor. He has upheld medical ethics during decades of practicing and promoted hospital development by means of meticulous management.

## Advance the clinical application and innovation of particle therapy from scratch to ensure good curative effect and patient safety

As the first medical institution in China equipped with proton & heavy ion radiotherapy equipment, SPHIC has made remarkable achievements since its establishment following 10 years of preparations. For Dr. Guo, however, the effectiveness of particle therapy and patient safety are two top priorities. As the state-of-the-art technique in radiotherapy, particle therapy has no relevant experiences in China in the past. The hospital introduced the technology from abroad and gradually mastered it. Meanwhile, the hospital's clinical application and radiation physics are among the most advanced in the world within a short period of time through continuous study and innovation.

Based on the epidemiology of malignant tumors in China and by focusing on patient needs, the center offers clinical treatments for 5 major diseases including nasopharyngeal carcinoma, skull base tumor, lung cancer, liver cancer, and prostate cancer by utilizing the advantages of heavy ion technology, along with prioritized clinical research on pancreatic cancer. Satisfactory results have been achieved. For some less frequent tumors such as chordoma, chondrosarcoma, and adenoid cystic carcinoma, particle radiotherapy have also achieved good effectiveness. Heavy ion therapy or heavy ion plus proton therapy had been applied in treating 124 cases of prostate cancer (including

localized, locally advanced, and oligo-metastasis types), and the 2-year overall survival rate reached 98.4%. In particular, in 95 patients with localized prostate cancer, the 2-year overall survival rate reached 100%, and the 2-year biochemical recurrence-free survival was also 100%. Clinical studies have also shown that the application of proton & heavy ion therapy makes the radiotherapy of breast cancer safer and more precise. The mean irritation doses to the heart and lungs are reduced by about 50%, which has obvious advantages for the protection of these two vital organs.

Based on clinical cases and improved efficacy, the hospital has been dedicated to clinical research and innovations. Its clinical teams partnered with treatment and research institutions at home and abroad to conduct prospective clinical studies on such key issues as mobile target volume respiration-gated technology, dose delivery methods of particle therapy for different cancers, and optimized treatment models, so as to explore a Chinese solution of reducing the frequency of particle therapy and increasing the proportion of heavy ion therapy. Based on clinical practices, the radiation physics team of the center has developed a number of auxiliary devices for particle therapy such as rotatable treatment couch, isocentric rotatable treatment chair, and beam limiter. These auxiliary devices create more choices of beam incident angle to ensure multi-angle particle radiation, which expands the indications of the treatment system and further increases the therapeutic efficiency and utilization rate of the equipment.

### **Realize the objectives of precision treatment of cancers by capitalizing on clinical research and big data analysis**

According to Dr. Guo, the proton & heavy ion technology has multiple advantages over traditional radiotherapy; however, there are only a few successful cases of particle therapy, especially heavy ion therapy, for reference across the world. The rapid development of such technologies as gene sequencing, omics, and artificial intelligence has ushered cancer treatment into an era of “precision medicine”. Big data analysis can help find the most feasible treatment proposals for cancer patients. In China, cancer cases have risen year by year. Due to the heterogeneity of cancers, patients differ dramatically in treatment responsiveness, prognosis, and possibilities of metastasis and recurrence. Gene- and omics-based testing and big data analysis are needed to identify patients suitable for

conventional therapies and those suitable for targeted or proton & heavy ion therapies, so as to maximize the therapeutic effectiveness, reduce side effects, and thus achieve the targets of precision medicine.

Dr. Guo also mentioned that clinical studies on particle therapy are mainly conducted by research-oriented medical institutions in the United States, Japan, and Germany. Thanks to the studies and clinical practices by these particle therapy centers, proton & heavy ion treatment protocols have been established for many cancers. As China’s first medical institution equipped with proton & heavy ion therapy equipment, SPHIC is dedicated to relevant research as well and has launched about 10 prospective clinical studies, whose data and results are expected to contribute to the development of international guidelines.

### **Develop a first-rate discipline platform and talent-training base and build an international hospital brand through meticulous management**

Competitions among first-rate hospitals and disciplines have increasingly been intensified. FUSCC has been the best performer of operational efficiency among cancer hospitals in China and come out on top among comprehensive hospitals. In 2017, SPHIC passed the accreditation of the Joint Commission International (JCI) to become the first JCI-accredited proton & heavy ion facility in the world. Dr. Guo believes that meticulous management is indispensable to modern hospital management, and clinical efficacy, quality, and service can only be improved by establishing scientific, standard, and problem-solving service procedures based on scientific management concepts and informationized approaches. With two decades of experience in hospital management, Guo and his colleagues have proactively promoted and improved the hospital’s multi-disciplinary diagnosis and treatment model, provided customized therapies and whole-process management for cancer patients, and ensured both therapeutic effectiveness and patient’s quality of life, which is also a lifelong goal of a doctor.

He also said that as China’s top cancer center and proton & heavy ion center, FUSCC and SPHIC regards discipline development and talent training as the pillars of its sustainable development and also the foundation for building an international brand. With the support from Fudan University, the project of “Precision Cancer Medicine and Proton & Heavy Ion” received grant from the “Double First-Rate” program, aiming to integrate the

university's resources in terms of discipline development and scientific research, carry out scientific research on tumors and proton & heavy ion technology, and enhance talent training via the university's platform. In the field of radiation medicine, Fudan University now offers biomedical engineering master's program specializing in proton & heavy ion, with an attempt to train more talents on particle therapy. Notably, FUSCC is partnering with AME Publishing Company to launch a peer-reviewed English journal named "Precision Cancer Medicine", which will serve as an international exchange platform of precision cancer medicine and a stepping stone for the hospital to become Asian's first-class cancer center.

Over the past 30 years, Dr. Guo went to Shanghai for study from Jiangxi and then became a doctor, teacher, and hospital manager; however, his perseverance and dedication to overcoming obstacles has never changed. He is committed to devoting lifetime to his beloved career as a doctor and as hospital manager.

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