

## The mobile X-ray machine

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The specialty of radiology and radiotherapy began in 1895 when Wilhelm Conrad Roentgen, Professor and Head of the Department of Physics at the Julius Maximilian University at Wurzburg in Germany, discovered the X-ray.<sup>1</sup> The medical community throughout the world soon realised the importance of this brilliant discovery and was eager to learn more about this 'shadowgraph' or 'roentgenogram' that was named after Prof Roentgen.<sup>2</sup>

In the first two decades following its discovery, X-ray was mainly used to localise bullets in wounded soldiers and to diagnose fractures. The first X-ray machine in Hong Kong was installed at the Alice Memorial Hospital in 1910.<sup>2</sup> In the early days, this 'Roentgen Ray Apparatus' was mainly used for diagnosing tuberculosis and fractures.<sup>3</sup> Acquisition of radiology equipment and the field of application was rapid in Hong Kong after 1910. A government radiology service in Hong Kong was first provided in 1929 in the Government Civil Hospital, and replaced in 1937 by the radiology department of Queen Mary Hospital in Pokfulam.<sup>2</sup>

As the X-ray machine became more generally used, its design was also steadily improved. The Metalix X-ray machine was first introduced in 1925 and was the first X-ray tube that was shielded to prevent unwanted X-ray exposure.<sup>4</sup> The main body of the X-ray tube was a chromium iron cylinder shielded by lead and sealed directly by glass at its end. This design ensured that X-rays could only leave the tube via the glass window.<sup>1,5</sup> Later models provided insulation against high voltages, significantly decreasing the number of electrical accidents that were not uncommon during the 1920s to 1940s.<sup>4,5</sup> Another significant technological advancement was the development of a rotating anode. The anode, being the target bombarded by an accelerated stream of electrons to generate the X-ray, becomes heated in the process. Its rotation exposes a different part to the electrons and allows for rapid and repeated X-ray generation without exceeding the maximum tolerated temperature, thus making it possible to image fast-moving organs.<sup>1,4</sup> In the 1960s and 1970s, screens for radiography were improved with better film speed so that less radiation was required for each exposure. There was also improvement in the design of image intensifiers producing better quality images. In the 1980s, an innovative change occurred

in radiography with the development of digital radiographs.<sup>1</sup> Today, mobile wireless digital X-ray systems are available, allowing X-ray images to be acquired and processed within a short time.<sup>6</sup>

On the Philips Metalix machine featured in this article (Fig), the X-ray tube and the cassette holder are mounted at opposite ends of a rotating arm connected to a mobile stand. The rotating arm can be adjusted to various angles and heights, making this machine suitable for numerous types of radiological examination.<sup>7,8</sup> Based on the available historical information of X-ray machine development over the decades, it is likely that this machine that was acquired in the 1950s was a more advanced version,



FIG. The Mobile Philips Metalix diagnostic X-ray machine, donated by Dr Hans Tang to the Hong Kong Museum of Medical Sciences in 1996, showing the X-ray tube mounted on one end of the mobile arm and the cassette holder (black plate) on the other end

shielded for unwanted X-rays, protective against high voltages, possessing a rotating anode, and mobile. The mobility of the X-ray machine enabled bedside imaging and facilitated its use in ambulant mass chest radiography for screening of tuberculosis which was globally prevalent in the pre-1960s.<sup>3,9</sup>

The late Dr Hans Tang (湯于翰 1913-2014), who donated this mobile machine to the Hong Kong Museum of Medical Sciences in 1996, was a renowned philanthropist and the vice-patron of the Hong Kong Museum of Medical Sciences Society. He was born in Hong Kong but grew up in Zhenhai in Ningbo City, Zhejiang Province. He graduated from the Shanghai Medical University in 1934 and underwent postgraduate training at Louvain University in Belgium, where he served as Research Fellow and Resident Physician. It was here that he also completed his thesis on the 'Principles of radiotherapy', for which he was awarded the degree of Senior Doctorate of Medicine. His interest in medical specialties included radiology, microbiology, and oncology.<sup>10</sup>

He returned to China in 1938 during the War of Resistance against Japanese Aggression and became the President and Physician-in-Charge of the Shanghai Sino-Belgian Radium Institute, at the time one of the only two centres with radiotherapy equipment. The late Dr Tang also became President of the Shanghai Red Cross Hospital and leader of several other medical organisations. He settled in Hong Kong in 1945 shortly after the Second World War and started his private practice in 1948 specialising in cardiology. He was elected Member of the Royal College of Physicians of Edinburgh and Royal College of Physicians of London in 1948. At the time, he was one of the few physicians in private specialist practice in Hong Kong. The X-ray machine featured in this article was used in his clinic during the 1950s to 1970s.<sup>10</sup>

The establishment of private practice in Hong Kong with diagnostic radiology equipment as far back as the 1930s has been documented in the literature. The use of X-ray equipment by traditional Chinese bonesetters and in medical and dental clinics in the private sector in the 1950s has also been reported. In the early days, there appears to have been a lack of concern regarding the potential dangers of radiation. Nonetheless, the medical community in Hong Kong gradually realised the importance of enforcing radiation safety and a Radiation Board was established in 1952 and the Radiation Ordinance and Regulations were legally gazetted in 1965.<sup>3</sup> Dr Tang's clinic was one of the few private clinics from the 1950s to 1970s to have installed an X-ray equipment. With his studies in radiotherapy in Belgium and experience in the Shanghai Sino-Belgian Radium Institute, his training would have stood him in good stead regarding the installation and operation of the X-ray machine, and personnel radiation protection.

In 1956, Dr Tang founded the Society of Physicians of Hong Kong with his colleagues. In the following decades he was elected fellow of several colleges, including the International College of Surgeons, American College of Chest Physicians, American College of Cardiology, Royal College of Physicians of Edinburgh, Royal College of Physicians of London, Hong Kong College of Physicians, Hong Kong College of Cardiology, Hong Kong Academy of Medicine, and Patron of its Foundation. He also served as a member of the Radiation Board of the Hong Kong Government and the Medical Licensing Committee of the Hong Kong Medical Council, and was President of the International College of Surgeons in Hong Kong, the Hong Kong Chinese Medical Association, and the Society of Physicians of Hong Kong. In 1997, he helped establish the Medical School of Ningbo University and the Dr Hans Tang Medical Centre in his hometown.<sup>10</sup>

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