

The Teaching of Radiology

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Abstract

Despite its late arrival, Radiology (Imaging) has had a dramatic impact on patient care from both the diagnostic and therapeutic viewpoints. Singapore was one of the early users of the “new rays”. This article briefly traces the early history of Radiology in Singapore and tracks the teaching and training given to medical students at the Faculty of Medicine. While its instructional components have increased, the scope of Radiology has grown even more quickly, giving rise to the need for greater exposure of medical students and young doctors to Imaging.

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A record of Diagnostic Radiology would be incomplete without reference to Wilhelm Roentgen, who discovered the rays that he could not comprehend; hence, X-rays. The day was Friday, 8 November 1895, as he worked on cathode ray tubes at the University of Wurzburg, Germany. These rays penetrated opaque substances, blackened photographic plates and caused some salts to fluoresce. Not unexpectedly, the first X-ray photograph the world saw was that of Mrs Roentgen's hand.

The medical profession was quick to sense the potential of being able to see “inside” the patient. True to his calling, Roentgen gave his work to the world. Hence, such apparatus were readily made and sold inexpensively from the onset. For his achievements, he was awarded the Nobel Prize for Physics when it was inaugurated in 1901. Many journals, including the *British Medical Journal* and the *Lancet*, published articles recording the value of these rays. Within four months, its value in the detection of bony injuries featured prominently in a medico-legal issue in London.

The earliest recorded mention of these rays in Singapore is dated 14 February 1896, when the *Straits Times* published an account of his discovery. By June 1896, the *Free Press* had reported that improved tubes now enabled the heart and lungs to be observed on a fluorescent screen and that the mechanism of swallowing could be visualised.

Before long, the therapeutic capabilities of the rays were reported, and the use of contrast material was initiated. By the turn of the century, they were being used to screen parcels in the post office, as in airports all over the world today.

The first equipment in the region was demonstrated at a meeting of the Perak Amateur Photographic Society at Taiping in February 1897 where the “value of seeing inside a patient and a fish fully answered the expectations”.¹

The first recorded use of radiological equipment in Singapore was in January 1898, when an apparatus was installed at the Municipal Office under the charge of Dr WRC Middleton and “was made available to any qualified medical man.” Soon after its installation, it was used to visualise the bullet of a man shot in the back.

In what is probably the first recorded attempt at continuing medical education (CME) here, a series of 7 lectures were held late in 1898; one of which featured the Roentgen Rays. It was noted “the rays had not only made the diagnosis of obscure injuries and ailments easier but they had saved patients a vast deal of suffering.”²

Although the Straits Settlements and Federated Malay States Government Medical School commenced on 3 July 1905, there was no mention of X-rays in any publication of that period in relation to the School. On 3 July 1907, the *Straits Times* reported that the government was about to spend \$650,000 to upgrade the hospital.

Although there were no records of a machine in a Singapore hospital, the Straits Settlements Annual Report, 1911, stated that “the use of efficient Roentgen Ray apparatus is badly needed”. “The existing instrument which has been in use for several years is practically useless for diagnostic purposes ... A new machine is to be obtained next year.”³ A lengthy editorial on 6 December 1911 implied that there had been a working machine providing good service at the

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General Hospital for several years. However, there are no records of this equipment. This was not the machine first installed at the Municipal Office in 1898. “Records of that machine and its utilisation by doctors were lost after two years,” recalled Dr JW Winchester.⁴ An extensive search by Dr F Y Khoo failed to turn up any further information on the first X-ray machine.⁴

The next machine was installed and “has worked satisfactorily on the whole but was affected by humidity”.⁵ By 1914, it was working well and used for both diagnostic and therapeutic purposes.

The first record of a radiologist in the region referred to Dr H Mowat, who was the radiologist at the Federated Malay States Medical Department. He arrived in 1920 and passed away 3 years later at the age of 45 years.

No record of this era would be complete without a discussion on Dr John Sutton Webster and his pivotal role in the development of Radiology. Dr JS Webster, MB ChB worked as a Medical Officer at Tan Tock Seng Hospital from 1909. He was appointed Professor of Medicine, King Edward VII College of Medicine in 1922 but was more interested in Radiology and Electrology. He obtained DMRE in 1926 but had worked at the X-ray Department since 1921, in addition to being Professor of Medicine.

When a new General Hospital was opened on 29 March 1926, the volume of work justified the specialist post of radiologist. When this new position was approved in July, Dr Webster promptly requested that he be relieved of his position as Professor of Medicine to assume the job.

He was then appointed Lecturer in Radiology. This is the first time that a radiologist appeared on the Teaching Faculty of the King Edward VII College of Medicine. He continued in this position until his retirement in 1939. Historically, the records showed that Dr Webster was listed under the Department of Medicine from 1927 to 1933 and the Department of Surgery from 1933 to 1939. He was concurrently in charge of Radiology at Tan Tock Seng Hospital.

His tenure also saw the appointment of a “Nursing Sister” for Radiology. Miss MB Hornsby possessed a Certificate of Radiography and Medical Electricity and was effectively the first trained radiographer.

Initial records of contact with medical students appeared around this period as the students accompanied patients for examinations at the department in the course of their clinical clerkship. They were also taught how to interpret radiographic findings both on the “screen” and the radiograph. The records showed:

1927/28 – Radiology was taught to final-year students in the first and second terms as a formal posting.⁶

1928/29 – Radiology demonstrations were carried out to

fifth-year students only.⁷

1929 – A ward at Tan Tock Seng Hospital was converted into laboratories, a lecture hall and an X-ray room, and the use of X-rays was frequently reported at medical meetings.

The course in 1930 consisted of 20 lectures/demonstrations held once a week and extended over 2 terms. In addition, students were posted to the Radiology Department full-time for 2 weeks at a stretch. It is significant to note that more time was allocated than 50 years later.

The year 1932 saw a Course of Elementary Instructions initiated by Dr Webster. “There was close interaction with the students and radiologist as the students were shown how to interpret radiographic findings both on the screen and radiograms.” In addition, in the course of their clinical case taking, students brought the cases for fluoroscopic examinations, etc.⁸ These reports were repeated over the years, indicating that there was little change in the overall concept of radiology training.

A significant reference to Radiology appeared in 1934.⁹ Sir Richard Needham, Inspector of the General Medical Council, visited in January 1934 and commented that “there was a particularly well equipped X-ray Department at the General Hospital in which each student is given a course in Medical Electricity, Radiology and Röntgen-therapy.”

The 1937 Report recorded that the “senior students’ course included Anatomy of the Central Nervous System, the revision of anatomy of selected regions of the body and a new course of surface and X-ray anatomy, to meet the requirements of the General Medical Council”.¹⁰

A significant advance in 1938 saw a Fracture Unit established at Tan Tock Seng Hospital where “reductions and plaster applications are done with the use of a portable X-ray machine and hand fluoroscope. A blackboard has also been added and it is hoped that the teaching of the modern treatment of fractures will be expanded so that the students may be able to attend a comprehensive course”.¹¹

When Dr Webster retired in 1939, he was succeeded by Dr Winchester as Lecturer in Radiology. The programme for Radiology in 1938/39 was quite wide-ranging.

“An elementary course in Medical Electricity, Radiology and Roentgen-therapy is given from October to March each year to sixth-year students. Each course consists of twenty lecture-demonstrations held every Thursday during terms from 2 to 3 pm in the X-ray Department, General Hospital.

The syllabus included:

X-rays – Production: physics: technique: measurement: protection against.

X-ray diagnosis of disease of the various systems.

X-ray diagnosis of injury to bones and joints.

Quick localisation of foreign bodies.

Pyleography: Cholecystography: use of lipiodal in the spinal canal and in the sinuses.

X-ray therapy: superficial and deep: indications and methods of application.”¹²

After the war (1946), Dr RA Pallister, Acting Professor of Medicine, reported that demonstrations of X-ray screening were given to students attached to the medical wards. The students were taught the technique of neurological examination, including the interpretation of X-rays. This may be the first reference to Radiology being taught by non-radiologists.¹³

A report by Dr Winchester in the Annual Report of King Edward VII College (1949) reads

“...the usual course of twenty lecture-demonstrations were given during the October-December term and January-April term. A new course began in 1949.

The greater part of the course is taken up by diagnostic radiology, but an outline of the theory and scope of radiotherapy and electrotherapy is also given.

An attempt is made during these courses to impress upon the students the close relationship of radiology to the basic subjects of anatomy, physiology, pathology and clinical medicine, and to show how information derived from these, when correlated with radiological appearances, may lead to the solution of problems in diagnosis.

The collection of type films for demonstration purposes which was built up before the war was entirely lost, and will take some time to replace, but steady progress is being made in this direction. It is proposed next year to ask for a small vote for the purpose of commencing again the production from radiographs of a set of lantern slides for teaching purposes.”¹⁴

A syllabus similar to that of 1938/39 appeared in the University of Malaya in Singapore Calendar, 1962.¹⁵ The next available record shows that from 1966, a course in Radiology for medical students was mentioned. This was delivered once every week for two terms. Initially, most of the lectures were given by Dr FY Khoo and, subsequently, by his successor, Dr KW Chow. This state of affairs persisted through 1975/76.¹⁶ The lectures covered the whole spectrum of Radiology and Imaging, and presented students with an overview of the capabilities of imaging, acquainting them with the more recent developments, and the strengths and weaknesses of these technologies.

In 1981, the University established a Department of Diagnostic Radiology at the Medical Faculty. Although no full-time Head of Department was appointed, Dr KW Chow became the Clinical Associate Professor of Radiology in 1981/82 and Dr Lenny Tan, the Clinical Professor in 1984. There was still little change in the formal teaching of Radiology. Twenty sessions were allocated to lectures in Radiology and Nuclear Medicine, mostly given by radiologists from the Singapore General Hospital. Unfortunately, simple didactic lectures were hopelessly inadequate. As in all clinical disciplines, teaching is best done through tutor/student interaction. The nuances and implications of a discipline can never be communicated in a didactic lecture. However, there was never enough time on the curriculum for students to be posted to Diagnostic Radiology.

Much of Radiology was learnt indirectly during the many clinico-radiological conferences initiated in the mid-1970s, where radiologists and those from other specialties discussed difficult problems in diagnosis and management. It was useful for students who attended these sessions as they were able to see the relevance and value of Radiology. They continued with their visits to the Department to follow up on their patients and to ask for advice on the presentations they had to make at student clinico-pathological conferences.

The introduction of Interventional Radiology in Singapore in 1981 had a dramatic impact on Diagnostic Radiology as we were now more than just the provider of information on which others acted. We actively participated in the management of patients and in many instances, were able to influence and change the course of illness quite significantly. With Interventional Radiology and the greater application of cross-sectional imaging techniques like ultrasound, CT and MRI, the value of Radiology to patient care was obvious.

However, while students were being given Radiology “demonstrations” as part of their postings in Medicine, Surgery, Orthopaedic Surgery and Paediatrics, there was never enough time on their curriculum for them to actually spend time with the radiologists! Unfortunately, many misconceptions continued to be perpetuated and the more recent advances inadequately appreciated. During this time, the problem was always said to be the relative scarcity of radiologists. The real problem was not the willingness of the radiologist to go the extra mile but the unwillingness to make bigger structural changes.

The series of lectures/demonstrations were conducted in an ideal setting for an afternoon nap. The students, rushing from their morning postings at other hospitals, would be thrust into a cool dark room and given lectures on a subject that was not examinable. This cannot command much interest or attention and was the situation for many years.

Repeated attempts to have students posted to Radiology were unsuccessful.

A positive side to the teaching of Radiology in those days lay in the very close interaction that medical students enjoyed with the Radiology Department because they had to “chase” the results of investigations. They also spent time with radiologists in relation to their presentations. However, they were still rarely seen at procedures in spite of logbook requirements.

Professor Lenny Tan assumed the position of Professor of Radiology in January 1990 and moved to the National University Hospital. In the 1990s, the futility of the afternoon lectures/demonstrations was finally brought home. The didactic lectures ceased. Students were posted to Radiology for a week at a time, during which they received lectures and watched procedures in the department. The classes were divided into smaller groups, hence radiologists had to repeat themselves many times but smaller groups had the advantage of closer interaction.

Again, because of its low priority in the order of things, the postings usually took place just before the Professional Examinations. Many students would usually be more concerned about studying for their examinations, and furthermore, Radiology remained a non-examinable subject.

In the new millennium, additional programmes were initiated. To emphasise the value of Anatomy, lectures on radiological-anatomical correlations were conducted towards the end of the first year. This allowed the students to appreciate the details of anatomy visualised using the various imaging modalities and the value to patient care. In the second year, additional lectures on radiological-pathological correlations again highlighted the relevance of Radiology, in the diagnosis and subsequent management of various disease conditions. It demonstrated how Radiology was able to visualise disease processes and in the follow-up, its value as a barometer of treatment.

In recent years, radiologists have given lectures/demonstrations to students as part of their clinical postings to other departments in the final year. This is a very significant step forward because these demonstrations had always been conducted by non-radiologists in the past.

More recently, the advent of greater computing power at lower cost has resulted in the availability of the Patient Archival and Communicating System (PACS), Radiology Information System (RIS) and Hospital Information System (HIS). These digital communicating systems have been beneficial to patient care. At the National University Hospital, we have utilised a PACS System for the last seven years. Many of the historical deficiencies of film availability were immediately overcome and enabled the radiologist to provide more useful information, particularly on patients with long histories. The efficiency and responsiveness of

the Radiology Department was vastly improved, freeing the radiologists for other activities, including teaching.

The greater stability of the RIS and the HIS has enabled a more efficient flow of information, improving patient care. Whilst radiologists have had to deal with inadequate information previously, these are now available on the hospital system and reports are available there as soon as they are processed.

While all of this has had a major impact on patient care, there is a downside. The radiologist risks being increasingly isolated as he sees less of his clinical colleagues. More importantly, the availability of information has resulted in fewer students turning up at the department to discuss issues pertaining to their patients. This has reduced direct interaction with students outside of their postings.

A more recent development has been the use of computer-based interactive programmes to teach Radiology. Many of these are commercially available but interest in such programmes has dwindled. There is an increasing realisation that while these programmes are interactive, they do not provide enough room for discussion. Those of us who practise Radiology are fully aware that the X-ray image is never black and white and that there are numerous shades of gray. This applies equally to the patient and his disease state. It is, however, an excellent medium in which to teach basic principles.

Medicine is becoming increasingly fragmented into many specialties and subspecialties. The patient, however, is still a whole person and probably has other comorbidities. The more we are able to communicate, the greater the depth of understanding, and the more specialties involved, the greater our ability as a whole to make the right decisions and manage our patients. Radiology is an integral part of this team and greater appreciation of the capabilities of the Radiology Department will facilitate better patient care. This can only come with knowledge and information from the onset of training.

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