A Brief History of Radiology

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26.1 Introduction

The X-ray (or the 'new light') was discovered quite coincidentally by Wilhelm Conrad Röntgen on *8 November 1895* in Würzburg, Germany. Röntgen, a professor of physics, conducted experiments focussing on light phenomena and other emissions generated by discharging an electrical current in a highly-evacuated glass tube (a so-called *Crookes tube*, named after the British investigator William Crookes).

To Röntgen's wonder and disbelief he noted that an object across the room began to glow when his cardboard-shrouded tube was charged. This object, present by mere coincidence, turned out to be a *barium platinocyanide-coated screen*, and whilst holding various materials between the tube and screen to test the new rays, Röntgen saw the bones of his hand clearly displayed in an outline of flesh.

Röntgen gave his preliminary report ('*Über eine neue Art von Strahlen*') to the *Würzburg Physical–Medical Society*, accompanied by experimental radiographs and by the image of his wife's hand (bearing a ring on the right ring-finger). By New Year's day he had sent the printed report to physicists across Europe.

By the January of 1896 the world was gripped by '*X-ray mania*' and Röntgen was acclaimed as the discoverer of a medical miracle. He was later awarded the first *Nobel prize in physics* in 1901, upon which he donat-

F. van Gelderen, *Understanding X-Rays*

ed the prize money to his university, declined to seek patents or proprietary claims on his discovery of the 'new light' and eschewed eponymous descriptions of his discovery and its applications.

It is of interest to note that *Goodspeed* and *Jennings* obtained a radiograph of coins by accident on 22 February 1890 and that the plates lay unnoticed and unremarked upon until Röntgen's announcement caused them to review their images. Neither claimed any priority to the discovery.

By *mid-January 1896* the headlines in newspapers proclaimed 'new light sees through flesh to bones' and 'hidden solids revealed'. Within a week demonstrations were being set up at colleges, high schools and public venues. One excited inventor speculated that 'soon every house will have a cathode-ray machine'.

Thomas Edison, among others, was eager to 'perfect' Röntgen's discovery. Edison's work resulted in the development of a hand-held fluoroscope, but he was disappointed at being unable to manufacture a commercial 'X-ray lamp' for domestic use. His efforts to obtain an X-ray of the human brain in action kept reporters waiting outside his laboratory for weeks. *Falsified images* were common and the much-admired 'first radiograph of the human brain' was in reality a pan of cat intestines radiographed in 1896 by H. A. Falk.

Apparatus became widely available and soon special 'X-ray outfits' at low prices meant than anyone could produce an 'X-ray picture'. Studios opened to obtain '*bone portraits*', poems relating to the X-ray were written, and the metaphorical use of the rays was popular in political cartoons, short stories and advertising. Detectives touted the use of Röntgen devices in following unfaithful spouses, and *lead underwear* was manufactured to foil attempts of peeking Toms in possession of 'X-ray glasses'.

The *public* was fascinated with all these new developments, but the *medical world* immediately recognized the enormous importance of the discovery. Soon not only 'bullets, bones and kidney stones' were exposed to the Röntgen ray, but the X-rays were trained on prevalent diseases such as tuberculosis and malignancies. By early 1896 the *first angiography* (with injection of mercury compounds at post-mortem), moving-picture X-rays and military radiology images were obtained. (*Military applications* included the British River Wars on the Nile in 1896.)

The necessary apparatus was easily acquired. An evacuated glass tube (with anode and cathode), and a generator (coil or static machine), combined with photographic materials, could set anyone up in business as a ‘*skiagrapher*’. A variety of people tried their hand in the field, among them electricians and photographers.

For the first time in mainstream medicine a complex electrical machine intervened in the traditionally sacred relationship between physician and patient. Since the early nineteenth century, however, *electrotherapy* had been popular for the temporary relief of real and imagined pain. The same apparatus used for electrotherapy could generate X-rays and those with machines simply had to purchase a tube. As their previous practice had involved contact therapy, electrotherapists thought of using X-rays in a similar way. In January 1896, *Emil Grubbé*, a Chicago electrotherapist and assayer, irradiated two patients with cancer, noted palliative effects, but did not publish his results till much later. Grubbé himself underwent over 100 operations, including amputations, as a result of his lifelong exposure to X-rays.

By 1905 many hospitals had ‘*X-ray rooms*’ or ‘*X-ray labs*’, but most early facilities were hot, dark, disorganized and crowded with wires and apparatus, and frankly dangerous for patients and practitioners alike.

Early radiologists were unconcerned about daily exposure to X-rays to gauge the strength of tubes, perform demonstrations, position and steady patients during therapy and even to calculate an ‘*erythema dose*’ on their own hands. Wives and female assistants often served as test subjects to determine if a tube was ‘*ready*’ for the day’s work.

In February 1896 a physics professor at Vanderbilt University in America persuaded the dean of the medical school to ‘sit’ for an experimental skull X-ray. Three weeks later the dean’s *hair fell out*, an event treated with some hilarity by those recording the event. Later in the year further similar results were reported, including redness, numbness, epilation, desquamation, infection and severe pain, all these effects being associated with irradiation. Initially ozone generated by static machines, excessive heat and moisture, overexposure to electricity and ‘X-ray allergy’ were thought to be responsible for these effects and there was a general reluctance to blame the actual X-rays.

In the early months X-rays were regarded as harmless and soon a variety of *zinc ointments* were marketed for the reddened noses and hands of ‘X-ray operators’. Although many had noted difficulties with ‘*X-ray burns*’ it was not until the death of *Clarence Dally* (the long-time assistant of Thomas Edison in X-ray manufacture and testing) in *1904*, that observers finally agreed that the magic new rays could kill as well as cure. *Early efforts at protection* included lead screens, heavy aprons, metal helmets and other paraphernalia which caused the practice of radiology to become even more uncomfortable and difficult.

26.2 Radiological Investigations of Historic Interest

All the investigations detailed below date back to the late 1970s and are now obsolete.

Figure 26.1. A middle-aged man with a long history of coughing and purulent sputum production was referred for bronchography. The bronchogram (with dionosil) demonstrates cystic bronchiectasis of the left lower lobe. Subsequent left lower lobectomy was performed. [High-resolution CT has now superseded bronchography.]

Figure 26.2. An abdominal radiograph in a young woman with known malignancy obtained 48 h after injecting lipiodol ultrafluid into lymphatics on the dorsal aspects of the feet. IVP was performed in conjunction with lymphangiogram. The internal structure of the lymph nodes is particularly well seen with filling defects in an enlarged right external iliac lymph node due to metastatic deposit (*arrow*).

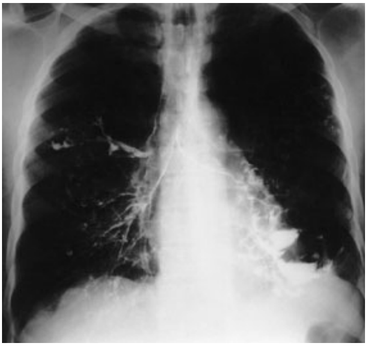

Fig. 26.1. Bronchogram of a middle-aged man with a long history of coughing and purulent sputum production

Figure 26.3. Amniocentesis performed in a 28-year-old woman with polyhydramnios with water-soluble and oil-based contrast media introduced, the former seen in the gastrointestinal system of the foetus at 24 h and therefore excluding an obstructing gastrointestinal tract lesion. The vernix caseosa is coated with the oily medium, better seen on an earlier radiograph of the gravid abdomen at 3 h (not shown), and thus excluding a superficial soft tissue abnormality. Maturity close to term and no congenital bony or other abnormality noted.

Fig. 26.2. An abdominal radiograph in a young woman with known malignancy obtained 48 h after injecting lipiodol ultrafluid into lymphatics on the dorsal aspects of the feet

Fig. 26.3. Amniocentesis performed in a 28-year-old woman with polyhydramnios with water-soluble and oil-based contrast media introduced into the amniotic space

Figure 26.4a,b. Ventriculographic images obtained in two young infants both demonstrating hydrocephalus involving the lateral ventricles (a) and entire ventricular system (b). The latter image demonstrates two fluid levels in the lateral ventricles, one between cerebrospinal fluid and radiological contrast medium and the other between air and cerebrospinal fluid. Note reduced thickness of compressed cerebral tissue.

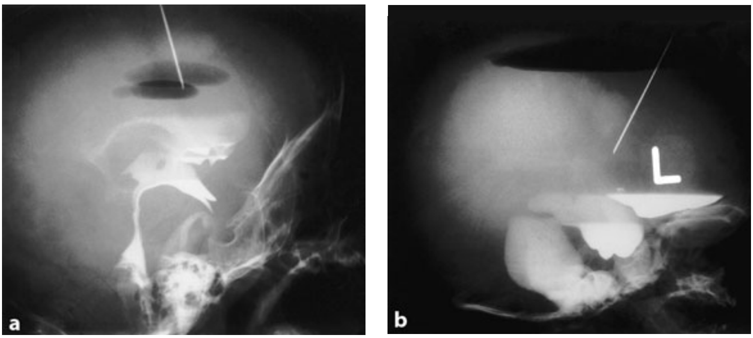

Fig. 26.4a,b. Ventriculographic images obtained in two young infants, both demonstrating hydrocephalus, involving the lateral ventricles in the one infant (**a**) and the entire ventricular system in the other infant (**b**)