Antique Hazards: A Latter Day Encounter with Radium

M. Donald Blaufox and Anthony R. Constable

Albert Einstein College of Medicine, Bronx, New York, and St. Paul's London Hospital, London, England

J Nucl Med 24: 79–82, 1983

During a visit to Europe last fall, I (M.D.B.) chanced upon an auction of antique medical instruments, and, as an active collector, I could not resist leaving a bid on a sphygmograph (Fig. 1). This late-nineteenth-century device for recording the pulse was offered as part of a lot that included a Morton's ophthalmoscope and several unlisted items in a carton. My bid was high, and a large carton of carefully wrapped objects was shipped to me. The sphygmograph was at the top of this "grab bag", which included a variety of other items, mostly related to optics. A small wooden box in the carton contained some cotton-like material and two vials; on one side of one vial was handwritten "Radio Varnish", and on the other vial "Spirit of Turpentine". The reverse side of both vials was labeled "F. H. Glew, Surgical Radiographer, Silver Medal (Highest Award, Paris 1900), 156 Clapham Road, London S.W." (Fig. 2). These rather innocuous-looking objects containing an unidentified clear fluid were of particular interest, since in England the surgical radiographer was the rough equivalent of the radiological technician in the United States, and I thought perhaps I had happened upon some objects historically related to the use of radiation. Shortly thereafter a small corked vial was retrieved from the box containing about three cm^3 of a course pink powder (Fig. 3). Much to my dismay this vial was labeled "Radium Compound" "0.4 Admiralty Specification" "2 gr". Although I assumed that the original contents must have long since been discarded, as a matter of precaution I borrowed a survey meter and discovered that the area in my office, where I had been unwrapping the materials, was the source of 5000–10,000 cps above background. Each of the instruments in the carton, most of which had their original cases, was a source of surface radiation that was best measured with a gas-flow counter and was in the range from three to five times background. There was no question that the vial marked radium did indeed contain radioactive material and that all of the instruments in the box had somehow been contaminated. In reconstructing the process, it was our assumption that the poorly sealed vial of radium had leaked radon, which, decaying within the confines of a box, deposited polonium all over the instruments, leaving a radioactive residue (Fig. 4).

On further surveying of the radium vial, it turned out that it contained about 17 μCi of activity and gave an

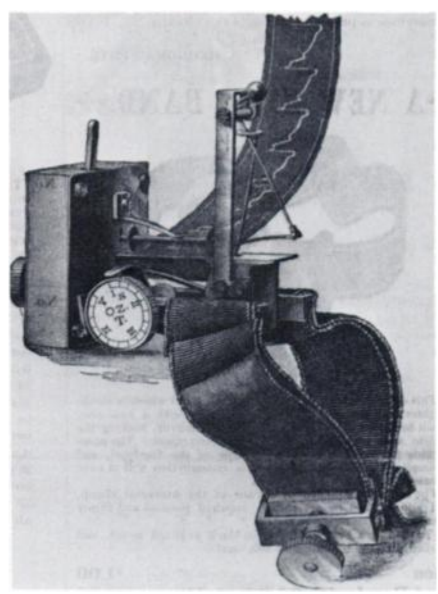

FIG. 1. Picture of a sphygmograph (circa 1890), an early device for recording the pulse. This is Dudgeon's type, which has a pressure-sensitive plate and is strapped to the wrist. Pulsations are transmitted through the plate to a needle that records on a piece of smoked paper moving through the drive mechanism. Result is a tracing of the shape of the pulse, and was surprisingly reliable in the diagnosis of a wide variety of heart diseases.

Received Aug. 2, 1982; revision accepted Aug. 9, 1982.

For reprints contact: M. Donald Blaufox, MD, PhD, Albert Einstein College of Medicine, Bronx, NY.

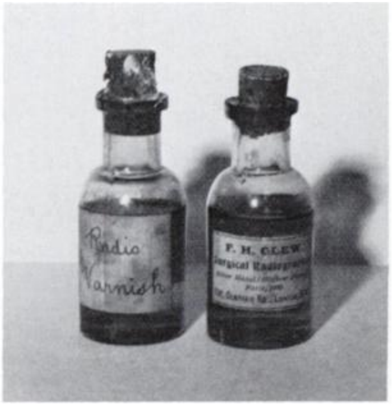

FIG. 2. Vials of radioactive liquid, the subject of this discussion. Note inscription: F. H. Glew, Surgical Radiographer.

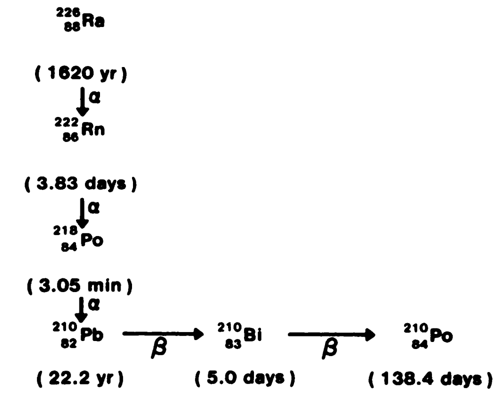

FIG. 4. Modified decay scheme for radium. Solid long-lived radium-226 decays by α emission to radon, a gas that decays by further α emission to polonium-218 (radium A), a solid, which would be deposited in the radon environment. A series of short-lived intermediates then arise through α and β decay in the Pb → Bi → Po series. The more important of these are diagrammed including Pb-210 (radium D), Bio-210 (radium E), and Po-210 (radium F). Pb-210 and Bi-210 are β emitters; Po-210 decays by α emission to stable lead-206. Gamma activity is emitted as well in the course of decay.

exposure of about 10 mR/hr at the surface. The residue left on the wrapping in the carton, which measured approximately 8 ft^3, gave an exposure of about 1 mR/hr at the surface. Approximately 1.7 μCi and 2.8 μCi was contained in each of the two vials of liquid, which looked rather innocuous and whose labels did not at all imply their radioactive content.

As a result of these findings, I notified the auction house from which the materials had been purchased, and a most interesting series of facts emerged. Mr. Constable, whom I recommended at the request of the auction house, agreed to investigate the origin of the radioactive material. The auction house arranged for Mr. Constable to survey all possible locations of the package immediately for any possible radioactive contamination, and none was found. An unrelated source was discovered coincidentally, namely, a military prismatic compass which contained about 5 μCi of radium serving to illuminate the dial.

FIG. 3. The vial of radium itself. First standard of radium was prepared in 1911 by Mme Curie, and consisted of 21.99 mg of pure anhydrous radium chloride. Honigschmid prepared the modern standard in 1934. Radium was discovered in 1898, shortly after the description of radioactivity in 1896 by Becquerel. If all of the activity is 2 g, as indicated, this would presumably be 120 mg of a mixture containing radium bromide or a similar compound.

The radium that was among the medical antiques was found to have originated from Dr. John Trotter, an 82-year-old physician of Kilcreggan in Dumbartonshire, Scotland. Mr. Constable visited Dr. Trotter, who explained that the radium and other items had been stored in a bookcase in his father's house and had not been touched for at least 50 yr. His father had died in 1940. Interestingly, the house in which the box had been stored was sold in 1981 to a naval armaments man based on an American nuclear submarine. Dr. Trotter had sent the carton, largely untouched, to the auction house, but he had removed five photographic items. These included developed photographic plates marked 1908, and an Ensign miniature camera from about 1925. They were contaminated with beta emitters whose energies, by liquid scintillation counter, were compatible with lead 210 and bismuth 210. The house where the material had been kept was located at Clynder on property near an American nuclear submarine base. A thorough survey of the entire premises did not reveal any remaining radium. The bookcase had been sold to a local antique dealer and was traced to Glasgow, where the National Radiological Protection Board monitored it and discovered it to be free of radioactivity, confirming that all of the activity had arisen from the radium vial within the confines of the carton and had been deposited on the items because they were sealed in the same container.

Dr. Trotter's father was Mr. John Trotter, an optician of Glasgow. The elder Mr. Trotter, who was the source of the instruments, lived in the large Victorian house at Clynder where Dr. Trotter had spent his childhood. John was an inventive man and, in 1895, when he heard about Roentgen's discovery of x-rays, he became interested in the subject and constructed his own equipment in the basement of his shop. It was to this basement that the first patients to be x-rayed at the Glasgow Western and Victoria infirmary were brought by horse-drawn ambulance. The instruments found associated with the radium date from approximately the same period (1895–1910). It seems likely that he used the radium for a number of applications, and although there is no record of his having been involved at any point in therapy, it certainly is possible that he or perhaps a colleague was using it for this purpose also. Several prominent Glasgow physicians were associated with Mr. Trotter, including Dr. McGregor, Superintendent of the Glasgow Victoria Infirmary; Col. McIntosh, Superintendent of the Western Infirmary; and Sir George Beatson, of the old Glasgow Cancer Hospital, now the Beatson Memorial Hospital. Mr. Trotter was also a friend of Lord Kelvin.

The radium used by Mr. Trotter originated from Frederick Harrison Glew, a chemist in London. Mr. Glew worked with and contributed to the development of x-ray tubes and published an arteriogram performed on a stillborn infant in 1899. Most of his work was with radium, and he served as advisor to the Ministry of Munitions during World War I. He developed severe radium burns on his hands and died around 1920, presumably of radiation poisoning. He was most active in this field between 1900 and 1910, and is named on the Hamburg memorial as one of the martyrs to radiation.

There are many ironies in this whole adventure, including the fact that the antiques were bought by someone in the practice of nuclear medicine and alert to its hazards. The house from which they originated is near the nuclear submarine base at Coulport and occupied by personnel from that base. The lesson for modern times is, of course, that even at this late date significant contamination with radioactivity from old radium salts is still quite possible, and a variety of sources of this material exist. Antique dealers involved with medical or scientific instruments should be careful about the kinds of things they may encounter, and especially those that may be dangerous. In some ways this is not unlike the recent observation by the NRC of a significant amount of radioactive contamination in gold rings manufactured with radioactive materials that had been discarded as waste.

The discovery of radium captured the imagination of lay people and scientists alike. This remarkable source of radiation at the turn of the century was popularly endowed with magical powers. The dangers were scarcely appreciated, even after investigators experienced repeated radiation burns. Many texts provide laborious calculations of the energy available from radium and

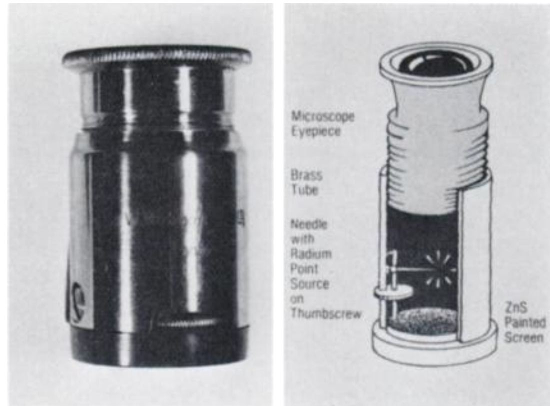

FIG. 5. Crookes spinthariscope. This device consists of a microscope eye piece with a brass tube at the far end of which is a screen painted with ZnS. A needle inserted in the tube is first dipped in a dilute solution of radium, which serves as a permanent source of activity. As the thumbscrew is moved, the needle moves closer to the fluorescent screen, generating bright flashes of light. The device was invented in 1903 (*spintharis* is Greek and means spark). It actually turned out to be useful scientifically, for Rutherford modified it, in 1908, to measure the charge of the α particle. Left is from author's collection, right from M. Brucer, reproduced with permission from Vignettes in Nuclear Medicine #99, Fig. 1, Mallinckrodt, Inc., St. Louis, 1981.

some individuals regarded radium as an investment. Soddy points out that the price of a milligram of radium rose from 8 shillings to 15 pounds between 1903 and 1912. Tousey noted that one gram of highly purified radium sold for $80,000 in 1909 and had increased 50% by 1914.

The fascination is perhaps exemplified by the fact that the spinthariscope—an early scintillation detector of alpha rays emitted by radium and invented by Sir William Crookes—could be purchased easily at a local optician's for a few shillings (Fig. 5).

Because of the mystery and lack of understanding of radium it was used for many medical purposes: It could be applied by an applicator in which radium was deposited or one on which it was painted in a solution of shellac (perhaps the use of Mr. Trotter's shellac but more likely used for luminescence applications). Radium was used in baths. Inhalations of air laden with radon were used, although it was known that "small animals which are allowed to breathe only air pretty well saturated with it die very quickly from its effects". Radium was applied locally in lupus, verruca, eczema, psoriasis, nevi, alopecia, keloids, arthritis, epithelioma, carcinoma of the breast, and even tic douloureux. Radium is also mentioned as having a tonic effect on the heart.

With all of these possible uses, it is actually surprising that radium does not turn up more often. In seeking freedom from disease it has been demonstrated repeatedly that people will eagerly grasp at each new discovery, only to learn the consequences after considerable harm has been done.

REFERENCES

1. SODDY F: The Interpretation of Radium, New York, G. P. Putnam's Sons, 1912
2. TOUSEY, S: Medical Electricity, Roentgen Rays and Radium, Philadelphia and London, W. B. Saunders Co., 1915
3. DUDGEON RE: The Sphygmograph: Its History and Use as an Aid to Diagnosis in Ordinary Practice. London, Bailliere, Tindall & Cox, 1881
4. GLEW FH: Radiogram of the Arterial System of an Injected Infant. *Arch Roentgen Ray*, 1899

Annual Spring Meeting
Pacific Northwest Chapter
Society of Nuclear Medicine

March 5–6, 1983 **Westin Bayshore Hotel** **Vancouver, B.C.**

Announcement

The Pacific Northwest Chapter of the Society of Nuclear Medicine will hold its Annual Spring Meeting on March 5–6, 1983 at the Westin Bayshore Hotel in Vancouver, British Columbia.

Dr. Donald Lyster, Program Chairman, announces the following plans for the Pacific Northwest Chapter's Spring Meeting:

Role of Gallium-67 in Diffuse Lung Disease
Frederick S. Mishkin, M.D.
Clinical Applications of Indium-111 Labelled WBC,
Polymorphyf, Lymphocytes, Malignant White Cells
I. Ross McDougall, M.B., Ch.B., Ph.D.
Antibodies in Cancer Detection
Steven Larson, M.D./Donald Lyster, Ph.D.

A Technologist Program is being planned for Saturday afternoon. SPECT and NMR speakers to be announced.

We cordially invite you to submit scientific papers for presentation at the meeting. Please contact Dr. Donald Lyster, Vancouver General Hospital, 10th and Heather, Vancouver, B.C., Canada V5Z IM9. Tel:(604)875-4111, ext. 3471.

Commercial companies are invited to participate. Space will be available for table-top displays. Please contact the Pacific Northwest Chapter Office.

AMA Category 1 credit for physicians will be available.

A Chapter General Business Meeting will be held on Saturday, March 5, 1983 at the scheduled lunch.

For further information and hotel and registration cards, please contact: Jean Parker, Executive Director, Pacific Northwest Chapter, SNM, P.O. Box 40279, San Francisco, CA 94140. Tel:(415)647-0722 or 647-1668.

6th Annual Meeting
Society of Nuclear Medicine
Hawaii Chapter

May 28–29, 1983 **Hyatt Kuilima Hotel** **Kahuku, Oahu, Hawaii**

Announcement and Call for Abstracts

The Hawaii Chapter of the Society of Nuclear Medicine will hold its 6th Annual Meeting on May 28–29, 1983 in Kahuku, Oahu, Hawaii.

The Conference Committee invites for presentation abstracts of original papers to be given at this 6th Annual Memorial Day Weekend Conference.

Papers are to be seven to ten minutes in length. Each abstract should be typed, contain a statement of purpose, methods used, results, conclusions and should not exceed 250–300 words. The title of the paper and names of authors should be stated as they are to appear in the program, with person giving the presentation underlined.

Send abstracts and requests for information to:

Patrick McGuigan
The Honolulu Medical Group
Department of Nuclear Medicine
550 South Beretania Street
Honolulu, Hawaii 96813

Deadline for abstracts is February 15, 1983.