MEDICINE

Handling Radium in Safety

Two Methods are Used in Treating Cancer Cases to Protect Doctor and Nurse from the Powerful Gamma Rays

By D. LINDSAY WATSON

SEVENTEEN and a half million dollars.

It would cost this amount if you could buy the whole of the world's supply of radium, the chief ammunition in the ceaseless warfare on cancer.

Yet a coffee cup would hold it all, if you were foolish enough to bring it together at one point. For it weighs only 250 grams, about half a pound.

More than half of this, 150 grams, is in the United States.

And of this the largest single store of the most precious substance, half a million dollars' worth, is to be found in New York City at the Memorial Hospital on 106th Street.

Cancer, most feared disease of civilized man, is the one and only objective of the work of this hospital. For two million Americans are the victims of this scourge at this very moment.

At Memorial Hospital eight grams, about one third of an ounce, are employed day and night against cancer.

People who are actually suffering with cancer are sitting in the waiting rooms of the hospital as one goes in to see Dr. Gioacchino Failla, physicist in charge of the radium.

Fear! Fear that oneself may be marked out by this still largely uncontrollable and unexplained kind of growth or tumor. This, one suddenly realizes, is the source of its fascination for the public, this the reason for the millions spent yearly in combatting it.

Hence the store of radium. Hence also the superhuman caution observed in handling this powerful substance.

For the radium sword is two-edged, as likely to hurt as to heal, if handled unskilfully. Radium, the best known curative agent for cancer, may also cause it, just as strychnine may act as a helpful tonic in small quantities but in larger doses as a powerful poison.

Martyred in the pursuit of knowledge, many early radium workers lost their lives from burns caused by the penetrating radium rays.

Dr. Richard B. Moore, leading radium chemist of America, and first to isolate it in quantity from Colorado ores, died recently in this very hospital from this cause. A tumor of the brain, due probably to the effects of the radium with which he had worked for so many years, killed him. Death in this way has been the fate of many of the pioneer workers with radium.

Memorial Hospital will have no martyrs, Dr. Failla decided when he began his protective work fifteen years ago. In this he has been completely successful; for though hundreds of treatments are given here every week not a single burn has occurred among the members of the staff.

Carried Tube in Pocket

Radium burns form on normal tissue exposed too long to the action of the rays but may not appear till two weeks or more after exposure. If they are severe they may later turn to cancers.

Henri Becquerel, famous French scientist and discoverer of the rays which give radium its power, suffered from a radium burn, though it was not fatal in his case. Anxious to show his friends the latest scientific wonder, he carried around a glass tube containing radium in his waistcoat pocket and was painfully burned.

Thanks, however, to Dr. Failla's success in devising methods of handling radium, physicians and surgeons all over the country are now using this treacherous substance without harmful effects. Three simple rules make this possible.

First: Keep as far away from the stuff as you can. Remote control is the watchword. The strength of the active gamma rays given off by radium falls off four times when one's distance from their source is doubled.

Second: When you have to get close up to manipulate, be as quick about your work as you can. Make the time of close exposure as short as possible. The dose adds up like sand falling in an hour glass.

The metal lead is the third shield of the radium workers. And a shield it is indeed, surrounding the radium supplies and heading off the dangerous shafts of rays from the bodies of the workers or patients.

Heavier substances are more resistant to the passage of radium rays as also of X-rays. For this reason they penetrate and pass more easily through flesh than bone, more easily through wood than iron, more easily through iron than lead. Gold would be a still better covering than lead if it were not so expensive.

Radium actually gives off three kinds of rays, alpha, beta and gamma by name. The alpha rays are easily stopped by a few sheets of paper, the beta and the weak gamma rays by a thin sheet of metal. The more penetrating gamma radiation, however, the kind used in treating cancer, keeps on coming even through as much as a four-inch-thick lead container.

The gamma rays are essentially similar to light in their physical properties even though they have such different effects on matter. They are immaterial waves but of much shorter wavelength, greater rate of vibration and greater energy than light waves. They are formed in the continual breaking down of the radium atoms.

A gas, radon or radium emanation, is also produced in the radium disin-

HE TAKES PRECAUTIONS

As a result of the efforts of Dr. Gioacchino Failla, of the New York Memorial Hospital, the handling of treacherous radium is no longer equivalent to martyrdom.

tegration and can be collected in suitable containers. Fortunately this also has the same kind of activity as radium itself, producing penetrating gamma rays for use in treating tumors.

Two methods of treatment are thus at the disposal of the physician. Easily accessible surface tumors are exposed to the direct action of the rays from a large amount of the radium itself. This is known as the "pack" method.

Application At Any Point

Or the extremely small amount of radon produced may be drawn off, placed in a small gold tube and applied at any point—being even inserted surgically in the middle of the cancer in many cases. At the Memorial Hospital half of the eight-gram supply is used in each of the two ways.

The four grams whose rays are used directly are enclosed in a massive lead block. A window or opening in the under side of the lead allows a beam to play on the proper spot on the patient's skin. A four-inch block of lead beneath his mattress protects others from the stray rays.

When not in use, which happens rarely, the inner section of the pack can be rotated so as to bottle up the powerful rays completely within the lead. The gamma rays then have to pass through four inches of lead before reaching the outside air. This discourages them somewhat and greatly reduces the danger. An air space 116 feet thick would be needed to reduce their strength in the same degree.

Despite its great weight, the "pack" is very easily moved and applied to the required place. It is mounted on a cradle having a universal-type motion and supported on a sort of travelling-crane arrangement.

The pack is in use continuously night and day. The treatments may be an hour or two in length and there are many patients waiting. Before one exposure is quite over a second patient lies down in a neighboring bed.

At the end of the first treatment the radium pack is quickly moved through an opening in the separating partition and placed over the second sufferer.

These two rooms are shut off from the rest of the hospital by doors of lead three-quarters of an inch thick. The attendant nurse can watch the progress of the treatment through little lead windows in these doors. These large doors make it possible for nurses to supervise the radium treatments over long periods of time without fear to themselves of serious burns.

The second method of treatment, by the emanation constantly given off by the radium, is more convenient than the "pack" method.

The treatment can be accurately localized; it can be applied to any tumor no matter how deeply seated. The emanation can be taken to any point in the hospital without fear of loss, and as many as 50 simultaneous treatments can be given by this method. Further, the loss of one of the little tubes containing the emanation is not serious, as it can easily be replaced the next day.

The radon does not keep its activity permanently, losing most of its strength after a week or two.

The second four grams of radium from which the radon is obtained are dissolved in water in the form of radium bromide. The activity of the radium is so great that the water of the solution is constantly decomposed into its elements. Enough hydrogen-oxygen gas mixture to half fill a liqueur glass is formed in this way every twenty-four hours.

With this gas comes a minute quantity of the radium emanation, about the size of a pinhead. At first this has no activity and can be handled with ease. The gas mixture is pumped off automatically, the hydrogen burned, and after drying, the minute remaining amount of radon is pumped into a gold tube for safe keeping.

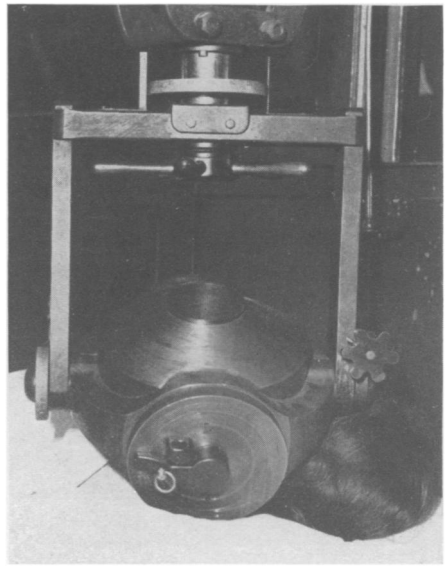
This tube looks like a knitting needle about seven inches long and three-hundredths of an inch in outside diameter. Inside, very little space is required for the radon—six ten-thousandths of an inch being the inside gauge.

Cut Into Short Lengths

The emanation does not reach its maximum strength until three and a half hours after removal from the solution, when its activity is some sixteen per cent. of the radium from which it came. Thus during the first hour and a half the radon can be manipulated without danger.

The gold tube containing the radon is placed in a machine which cuts it into short pieces, mostly not more than fourteen-hundredths of an inch in length, the length being chosen with regard to the specification of the physicians in charge.

The gold "seeds" are now ready to be tested and measured; for no radon application is made until the strength of its rays is accurately known. The "seeds" leave the cutting machine imbedded around the circumference of a brass cylinder.



THE RADIUM "PACK"

Four grams of the world's costliest element are at work in this four-inch-walled lead container being applied to the neck of a patient. Underneath the cancer sufferer is a lead slab also four inches thick which prevents the radium rays from escaping into the room.

When the gold "seeds" are now at full strength all the manipulations of the measuring room are by remote control. The "seeds" drop one at a time into the ionization current device, have their electrical effects measured and then drop by gravity into a second waiting cylinder. The next step depends on the way the "seed" is to be applied to the patient. Sometimes the surgeon imbeds the seed directly in the tumor. Otherwise the "seed" is placed in a small lead box and laid on the outside.

The technician who has charge of preparing the "seed" for application stands behind a lead block two inches thick and manipulates the charge with long forceps, his hand being shielded the while with a lead covering much like the guard of a sword. He watches the operation through a sheet of lead glass which provides safety.

Radium is successful in the treatment of cancer for two reasons. It may cause a destruction of the malignant tissue, at the same time toughening the surrounding normal flesh. A thick, impenetrable coating is thus formed round the cancer and prevents the migration of the death-bearing cancer cells to other parts of the body.