MIT Reactor Used Successfully For Brain Tumor Research

MIT and the Massachusetts General Hospital have announced jointly that eight patients with malignant brain tumors have been treated by neutron therapy at the Institute's Nuclear Reactor. Begun Last Year

A new technique has been used in the treatments, all of which were under the direction of Dr. William H. Sweet, neurosurgeon at MGH. In this technique, the skull is opened surgically to expose cancerous tissue to radiation 'touched off by a beam of neutrons created in the process of atomic fission in the reactor. The first of these patients was treated in November, 1960. Several years ago Dr. Sweet and his co-workers conceived this type of therapy and administered treatments at the Brookhaven National Laboratory reactor on Long Island. Operations at the reactor have involved two teen-aged boys, two men and four women.

Boron Injected

Treatments are based on the knowledge that certain boron compounds within cancer cells

in the brain after being injected into the bloodstream. The concentration takes place because normal brain tissues form a "barrier" against the boron. When neutrons emitted by the reactor are directed into the tissue area in which the boron is concentrated, they cause the boron atoms to emit alpha particles which have energy of 2.4 million electron volts. Since the alpha particles travel only about four millionths of an inch, their destructive power is limited almost exclusively to the cancerous tissue.

Gold Full Inserted

Although the entire operation lasts five to seven hours, the period of irradiation is the key factor. The MGH operating team first opens the cranium which has been originally opened at MGH two to three days previously to remove the main portion of the tumor and places tiny gold foils at various points within the exposed brain. These are readied by an assistant as to number and location. The

gold foils are neutron absorbers which are removed following irradiation treatment and, then studied for a count of the number of neutrons being emitted.

Ready To Ceiling

By late morning, the patient is ready for irradiation treatment. He is positioned so that his exposed brain is in line with the neutron beam opening in the ceiling of the medical room. The operating table is raised to the ceiling by hydraulic pressure. A collimator is attached to the skull and fitted against another collimator attached to the ceiling. Bags of neutron-absorbing lithium fluoride are placed around the outside of the collimators to protect other areas of the body from the beam.

Healthy Tissues Unharmed

The patient remains alone in the medical room while the irradiation process is taking place. All necessary controls are handled by monitoring devices in a sterilized area just outside the medical room. Even the anesthesia is continued through remote control. A window allows observation of the patient throughout the entire operation. Irradiation takes between 30 and 45 minutes. During the process, the brain is "blinded" with neutrons, but because about five times as much boron compound is concentrated in malignant as in healthy tissue, the alpha particles destroy only the cancer cells, leaving neighboring healthy brain tissues relatively untouched. The MIT Reactor is operated at maximum power by regular staff members throughout the entire operation period. While an operation is being performed in the medical room of the Reactor, other non-medical work is carried on normally. Several projects may be in progress on the main floor of the Reactor as treatment goes on in the room below.

Blood-Brain Barrier

In this relatively new process of neutron-capture therapy, a number of previously unencountered situations have arisen. For instance, in many organs there is little difference in the permeability of tumor and adjacent normal tissue by a variety of chemicals, but in the case of the brain, there is a marked difference. The brain is selective in the type and structure of materials which may penetrate it. Even the brain tumor, if limited, is under its control. Many substances which do penetrate the tumor rapidly are unable to enter the brain; this phenomenon is called the blood-brain barrier. It is necessary to wait two or three weeks following surgical removal of the main tumor to enable this barrier to build up again before the irradiation treatment can be performed.

Remote-Control Method

To accomplish the necessary anesthesia and monitoring which would be applied from outside the medical therapy room, a team of specialists, utilizing an anesthesia machine from England and a special anesthetic breathing valve from Denmark, devised remote control methods. The equipment was chosen because it enables the patient to breathe anesthetic gases and oxygen supplied from a distance without increasing respiratory work. The patient can expire metabolic gases directly into the therapy room where they can be of no harm to him. Electronic monitoring of brain valves, electrocardiograms and blood pressure affords the anesthetist the information that is need about the patient's physical condition during the irradiation, although the anesthetist is physically removed from the patient.

Rocket Fuel?

An interesting sidelight: one of the boron compounds which may be used for future injections of patients in the irradiation method is a nontoxic boron compound which is also being considered for use as a rocket propellant.

Museum of Fine Arts

Schedules Exhibitions

The Museum of Fine Arts in Boston announces several exhibitions in its galleries this month. Among the more permanent are the Exhibition of Thai Art Treasures of Thailand, the Zapf Exhibition, and The Passion according to Martin Schongauer.

These special exhibitions plus lectures, gallery talks, and events will be at the Museum through mid-April in most cases. Film programs and other art-expression forms are also often presented; check the Museum's schedule if you are interested.

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