The Laser — Its Role in Cancer

The editor interviews Alfred S. Ketcham, M.D., Chief, Surgery Branch, National Cancer Institute, National Institutes of Health, Bethesda, Maryland.

Dr. Grant: Dr. Ketcham, you and your associates, Dr. Robert Hoye and Mr. Grant Riggle at the Clinical Center of the N.C.I. have been investigating the use of the laser in cancer. What is the present status of this form of treatment?

Dr. Ketcham: The laser has been highly publicized as a possible method of treating cancer because of its amazing capacity to destroy tissue. As you know, the word “laser” is taken from the first letters of the following description of it: Light Amplification by the Stimulated Emission of Radiation. A typical arrangement of a laser system is shown in Figure 1. This powerful form of light can disintegrate tissue in so short an interval that it is difficult to record the time it takes.

Dr. Grant: What studies are you making?

Dr. Ketcham: Our studies with the laser have been designed to determine thresholds for gross and histological changes, both in normal and tumor tissue, to determine the short- and long-term effects. We are also trying to determine the effect of various biological pigments and tissue structure in laser interaction and finally, and of extreme importance, we are trying to evaluate the hazards associated with laser radiation.
DR. GRANT: Have you found that laser treatment of cancer is effective?

DR. KETCHAM: In spite of having available in our laboratory what today is the maximum output from lasers (over 1,000 joules per pulse) with the neodymium laser, we are unable to agree with much that has been published in the literature indicating that this instrument holds the potential of supplanting conventional therapy in the treatment of cancer. Certainly, the tumor can be destroyed as can normal tissue and relatively bloodless incisions can be made in the skin or muscle or liver (using the continuous wavelength laser) requiring only ligation of major bleeders. Yet with close scrutiny of our results, certain adverse findings have appeared.

DR. GRANT: What are some of these?

DR. KETCHAM: First of all, the laser impact to a tumor usually results in a splattering effect in which debris may spread as far as 10 feet from the site. Fragments of such tumor tissue debris have been collected and implanted into isologous animals resulting in tumor growth and eventual death of the animal. This effect would be particularly hazardous in lasering implants in the abdomen, chest or anatomically exposed areas where splattered viable tumor might implant and grow on highly vascular surfaces.
DR. GRANT: On the basis of your experimental findings, such splattering forces tumor tissue into adjacent fascial planes and could spread the disease over a wide and indeterminate area which could make decisions as to the extent of laser surgery extremely difficult.

DR. KETCHAM: That is true. Also, aside from splattering or what we call airborne dissemination and from the forceful spread of viable tumor into muscular or fascial planes of tissue, we have found within the laser impact site, islands of microscopically viable tumors. This may account for tumor regrowth that occasionally occurs following laser treatment.

DR. GRANT: What about dosage measurements?

DR. KETCHAM: That's another difficulty with lasers. Even with careful monitoring of the equipment and its energy output, significant variations occur from impulse to impulse and one must depend in a great part on the visible destruction that occurs to determine how many impulses must be delivered to the site. This is complicated by the fact that repeated impulses are effective only if the necrotic bed of the tumor is removed before subsequent firing, because the necrotic tissue itself will absorb most of the energy.

DR. GRANT: That's somewhat reminiscent of the early days of radiotherapy when dosage was calculated upon the erythema effect of the X rays on the skin.

DR. KETCHAM: Like X ray there is a possible similar genetic effect which must be considered with laser. Although no genetic alterations have been observed in the long-term follow-up of laser rodents, we do observe occasionally loss of hair on the undersurface of the mouse after lasering a skin or subcutaneous implant of the back. Current-day lasers are not quite in the electromagnetic wavelength spectrum of ionizing radiation but they do closely approach this level. Since there is a long-term carcinogenic effect from ionizing radiation, one must be concerned as to what role the laser someday may prove to have in this regard.

DR. GRANT: What about the safety of personnel involved with the use of the laser?

DR. KETCHAM: This of course is an important precaution which must be considered. If proper steps are taken, this should not be a deterrent to laser usage. However, we must bear in mind that the human lens is the best possible optical arrangement and the reflected beam of laser light, if it strikes the eye, can be focused by the lens of the eye to the retina and cause varying degrees of blindness, up to complete loss of visual acuity.

DR. GRANT: What is most promising in the treatment of cancer with the laser?

DR. KETCHAM: We have been studying the synergistic or additive effects of the laser on other modes of therapy. Using varying dosages and
schedules of drugs, radiation and laser, a significantly increased survival has been obtained. We feel that this type of combined therapy holds an intriguing potential for further investigation.

DR. GRANT: What eventual role do you believe the laser will have in the management of cancer?

DR. KETCHAM: There are too many poorly understood problems concerning the monitoring and reliability of the equipment's output and its effect upon tissues to speculate with any confidence about its future. While at present there is little information available to indicate that the laser will consistently do anything more than will the scalpel or ionizing radiation, it is possible that its ultimate role may be one of adjuvant therapy in specific situations in which surgery or ionizing radiation needs supplementation. One must remember, however, that it is always easy to criticize the unknown, or poorly understand new ideas, and thereby underestimate the potential of such forms of treatment.

DR. GRANT: Thank you, Dr. Ketcham.

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A DOCTOR'S DILEMMA

**th General Hospital
APO ***, U.S. Army
21 November 1943

Dear Joe:

This morning the fog outside at **th General Hospital is intense. The fog within is even greater. Sometime ago this institution was renamed "The Hospice" because of its similarity to that great monastery of Great St. Bernard Pass in Switzerland by that name; it means a "House of Entertainment for Strangers."

A few days ago an army nurse from another hospital struggled into our midst. In the night she gave birth to a girl baby. In four days, in spite of the best rehabilitation service, the baby died. For thirty-six hours solution of burial proceedings has been involved. The Graves Registration Service will bear none of it and say it's the burden of the nurse. She is too ill to do anything.

The British local authorities are resistant to aid in the solution.

It was suggested that the baby be cremated and the ashes be carried in a silver urn suspended on a necklace and worn by the mother as a reminder to others after the pattern of the "scarlet letter" on Hester Pryn. Priorities in critical material and fuel blocked this action.

Meanwhile, on a slab in a dark cold room of the mortuary of this hospital lies the tiny corpse, the mother of which is ill, the father unknown, unrecognized by church or state but legally for four days a citizen of the United States—waiting for the wheels of two great Democracies to decide a method of how, when, and where it may be interred.

At this present dark and dreary hour in the beautiful hills of Arlington a sentry paces solemnly back and forth before the Tomb of the Unknown Soldier of World War I.

Here in the forest where Robin Hood befriended the poor and oppressed, before the door of a hospital mortuary paces a bent, wrinkled faced, and worn old medical officer of the U. S. Army, praying to Almighty God (and Continental Congress) for guidance in finding a way to render to earth the remains of the daughter of the Unknown Soldier of World War II.

To: Col. * * * * *, M.C., U.S.A. * * * * * * * Very truly yours,

Hq. * * * * *, APO*** Colonel, M.C., U.S.A.