Clinical Use of Radioisotopes

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Preface

THIS TEXT for the clinician was originally conceived as a means of reducing the load of repetitive teaching that we have carried in the Clinical Radioisotope Unit, University Hospital, since 1947. Our first students were technicians. Then the departments of radiology, medicine and surgery made the Clinical Radioisotope Unit a regular rotation for every resident in these departments. In addition, many residents in pediatrics, obstetrics and gynecology, ophthalmology and other specialties sought training to use radioisotopes for specialized techniques, in clinical tests or for clinical research projects.

Since the Atomic Energy Commission agreed, in 1952, to allow certain physicians to use radioactive isotopes in private practice, we have given a preceptorship type of training to many men in practice so that they might become licensed by the Atomic Energy Commission to use radioactive isotopes, or so that they might learn how to use existing radioisotope centers most intelligently for the diagnosis and treatment of their patients.

Recently, every medical student at the University of Michigan Medical School has been assigned to the Clinical Radioisotope Unit as a part of his regular rotation during some part of his junior year.

This text was written primarily to help instruct such persons in the most common clinical uses of radioactive isotopes. The space devoted to each subject is weighted largely according to the popularity of each use. Chapter 10, covering the less commonly used radioisotopes, was added because these substances have been used to some extent in human beings or because it seemed likely to the authors that they might well be adapted to routine use in the future.

Physicians, medical students and technicians have shown us what we must teach and how it must be taught. Dean Ralph Sawyer and Dr. Henry Gomberg of the Michigan Memorial Phoenix Project and Dr. Albert Kerlikowske, Director of University Hospital, made our start possible. Dr. C. C. Sturgis, Chairman of the Department of Medicine, and Dr. Fred Hodges, Chairman of the Department of Radiology, promoted the start of the Isotope Unit. Drs. Isadore Lampe and Henry

Gomberg taught the senior author the approach to radioisotope work and a healthy respect for radiation. Dr. F. A. Coller, Chairman of the Department of Surgery, has contributed almost daily in innumerable ways to insure the best possible operation of the unit. Ardath Emmons, Associate Radiation Safety Officer of the University, has been indispensable in his help and instruction in radiation health physics. Dean A. C. Furstenberg has never failed us in our endless requests.

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Chapter 1

Certain Preliminaries

WHO SHOULD TRAIN?

WHO SHOULD receive training to diagnose and treat patients with radioactive isotopes? When in the physician's career should this training be acquired? How should one acquire this training?

On February 7 and 8, 1954, a Conference on Training in the Use of Radioactive Isotopes, sponsored by Northwestern University Medical School and Argonne National Laboratory, was held in Chicago to urge certain interested persons to crystallize their thinking on these problems. Our opinions coincide with the conclusions derived from this conference.

1. **The Medical Student.** The medical student is required to take chemistry and physics in undergraduate school. When he enters medical school, a separate course on radiation biology or clinical techniques should not be taught, both because of curriculum difficulties and because this material can be pertinently presented in relation to material included in existing courses. On the other hand, coverage of certain fundamental topics in this field should not be left to chance. Inclusion of such topics in specific courses should be recommended by the curriculum committees.

Instruction should be given in the freshman year on properties of radiation, principles of radiation detection and measurement, and interaction of radiation and matter. This material, presented in lecture and demonstration, should be included in either biological chemistry or physiology, depending upon which subject is presented first in the curriculum. As students are now taught to think in chemical terms of the structure and interrelationships of matter, they should also be encouraged to regard structure and function from a physical point of view. The effect of radiation on tissue might be taught in the second year in pharmacology or pathology. Instruction on radiation hazards and protection should be included in the curriculum, possibly in the junior year, as a part of the course work either in radiology or in public health and preventive medicine. The application of radioisotopes in diagnosis and therapy would be left entirely to the clinical departments as to what and how much to include.

2. **The Intern and Resident.** Current opinion agrees that radioactive isotopes should be a tool for the use of the skilled clinician in diag-

nosis and treatment. It is suggested, therefore, that the period of radioisotope training might best be presented at the end of two or three years of specialty training. The major quantity of radioisotopes used in clinical medicine today are administered by internists, radiologists and surgeons. Pathology may soon include training in radioisotopes as part of clinical laboratory pathology. We have made rotation through the Clinical Radioisotope Unit available to all residents in University Hospital to give them a broader knowledge of modern medicine, to prepare them to be relatively well informed members of their community in respect to questions of atomic warfare, civil defense programs and hazards which might arise or be alleged to arise from industrial use of artificial radioactivity, and, most important, to equip them for the possibility that they may be needed to head a clinical radioisotope laboratory in a university hospital or a leading hospital in a large community.

3. **The Postgraduate in Private Practice.** Physicians in private practice generally request training in a clinical isotope unit for one of two reasons. The specialist usually wants to learn how to handle a certain radioactive isotope in his practice as a specialized tool in his daily work. The general practitioner, on the other hand, desires information on the indications for the use of all clinical radioisotopes in his patients, how to prepare his patients for these isotopes, and how to handle his patients after the isotopes have been administered to his patients. This latter type of instruction should be available to any physician to keep him informed on the utility of this new development in modern medicine.

RECOMMENDATIONS AND REQUIREMENTS BY THE ATOMIC ENERGY COMMISSION

The Atomic Energy Commission has made several specific recommendations and requirements to be met by the person who wishes to use radioisotopes in clinical medicine. These statements are reproduced *in toto* as follows.

THE MEDICAL USE OF RADIOISOTOPES

Recommendations and Requirements by the Atomic Energy Commission

I. INTRODUCTION

The present procedures of the Atomic Energy Commission for the allocation of radioisotopes for medical research, diagnosis and therapy are set forth in this announcement. The recommendations for minimum clinical radioisotope training and experience for use of radioisotopes in human subjects have been established in advisement with the Subcommittee on Human Applications of the Atomic Energy Commission's General Advisory Committee on Isotope Distribution.

These recommendations are designed to provide guidelines for physicians and typify the nature rather than the precise extent of the desirable clinical radioisotope experience. For special situa-

tions, other experience may serve in lieu of the particular recommendations set forth in this announcement.

II. ADMINISTRATIVE PROCEDURE FOR RADIOISOTOPE PROCUREMENT

A. APPLICATION

A medical institution or a physician in an individual medical practice desiring to obtain radioisotopes, forwards to the Isotopes Extension*, Form AEC-313, "Application for Byproduct Material Licenses," and Supplement A, (Form AEC-313-a). If the radioisotopes are to be obtained as sealed sources (such as Cobalt 60 for teletherapy units or Strontium 90 for medical eye applicator), the applicant should complete the basic form (Form AEC-313) and Supplement B (Form AEC-313-b). These forms should be completed in accordance with the instructions attached thereto. Applications for use of radioisotopes in human subjects in an INSTITUTIONAL MEDICAL PROGRAM should be supported by the special information described under Section III, Page 4, Section IV, Page 6 and Section V, Page 7 of this announcement. For such use by a physician in his INDIVIDUAL MEDICAL PRACTICE the application should be supported by the special information described under Section III, Page 4, Section VI, Page 11 and Section VII, Page 13.

In considering such applications, the Atomic Energy Commission is concerned primarily with matters of radiological health safety. Toward this end the Commission seeks to determine if the applicant has equipment and facilities appropriate to the proposed use and whether the physician is trained in basic principles of radioactivity and has specific experience in the use of radioisotopes in the clinical situations being proposed. The information is indicated by the applicant on his application form and the supplementary sheets attached thereto.

B. LICENSE

Upon favorable review of the application (See NOTE below), Form AEC-374, "Byproduct Material License," is issued. This license permits the holder to procure radioisotopes in accordance with the conditions stated on the application and license forms and in Title 10 of the Code of Federal Regulations.

NOTE. The Isotopes Extension normally reviews applications proposing new or nonroutine medical uses of radioisotopes in collaboration with the Advisory Subcommittee on Human Applications. This review usually requires four weeks for completion.

C. TYPES OF CLINICAL RADIOISOTOPE PROGRAMS

The recommendations and requirements established by the Atomic Energy Commission for the clinical use of radioisotopes are designed to provide for two types of medical radioisotope programs. These are defined as follows:

1. Institutional Medical Radioisotope Program

Clinical radioisotope programs established by a medical institution and carried out under the guidance of a medical isotopes committee (See recommendations for membership and duties of a medical isotopes committee in Section IV, A. Page 6) are designated as "Institutional use." Licenses for institutional use require that the physician(s) named on the license form supervise the conduct of

* Allocations Branch, Isotopes Extension, Division of Civilian Application, U.S. Atomic Energy Commission, P. O. Box E, Oak Ridge, Tennessee.