

Symposium 12

Radiation Protection

PROTECTION OF HOSPITAL WORKERS IN CONTACT WITH RADIOACTIVE  
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dispersion of radionuclides used for diagnostic purposes is increasing and modifies the radiation environment in the general public. In spite of the use of short-lived radionuclides, some measures could be adopted to minimize the exposure of the nursing personnel to ionizing radiation. The purpose of this work is to provide a basis for discussion, namely for circumscribing the subject, for the advisable method to be used for determining the levels of exposure and for interpreting the results in the light of the recommendations of the International Commission on Radiological Protection.

A diagnostic nuclear medicine unit may be considered as an open system: the movements of the patients involve a constant flow of people in and out of the controlled area.

Patients disperse and cause minor environment problems. A general hospital unit may receive many patients with various radionuclide activities. These patients behave as external sources and as contamination sources. Their presence and the increase of such applications of ionizing radiation entail a problem of occupational health and of safe working conditions for the personnel.

The overall radioprotection situation is in this case completely different from that of radio-therapy units: the patient does not stay in the controlled area, hospital workers are not aware of, nor voluntarily engaged in, radiation work and there is not always a common administration between the hospital unit and the department of nuclear medicine.

The radiation of the patient submitted to examinations utilizing radionuclides falls within the scope of exposure resulting from medical procedures and is not considered here. Irradiation of visitors and of hospital workers, due to sporadic and individual contacts, is minor and, in most cases, of the same magnitude as that induced by out-patients. The problem of the exposure of the nursing personnel under review leads to specific measures but should take into account its potentially permanent nature during working hours.

The objectives of the radioprotection program should be clearly defined, taking into account the real working conditions involved by hospital workers. As far as possible, it should fulfil its aim without increasing this work and without incurring a too heavy supplementary load. The limit of the maximum permissible dose for the hospital staff is determined and conditioned by several factors, namely those under 2.4 and the following ones:

Children are involved but pregnant women or women of child-bearing age are particularly concerned.

Radionuclide diagnostic assays become ubiquitous in specialized medical units, making it difficult to consider the members of these units as occupationally exposed.

Authorizations. National regulations regarding ionizing radiation usually dispense from a nominative authorization the establishments which only occasionally use house ionizing radiation procedures,

provided the latter are carried out by the personnel, and are approved by the radiation protection officer of an authorized establishment.

3.4. Responsibility. The authority of the hospital establishment is responsible for the administrative and physical control, as well as for the information of the personnel. If the administrative control of the care establishment and of the department of nuclear medicine are distinct bodies, the former will naturally apply to and receive advice from the radiation protection officer appointed by the latter.

4.1. Each patient who has become radioactive through diagnostic procedures behave as an external radiation source for his environment per se and through his excreta.

The integral dose of external radiation at a chosen point in relation to the patient can be ascertained for each kind of examination. The individual irradiation of the personnel increases more significantly through a brief presence near the patient than through a longer stay further away. The time spent in the immediate proximity of this patient is therefore determinant and it is rational, in order to compute the maximum external radiation of the personnel by a patient who has had a given examination, to multiply the integral dose at a point close to the patient, for instance 1 meter away from his chest, by the mean fraction of the time, out of 24 hours, that this member of the personnel spends in the vicinity of any given patient.

4.2. Such a patient is also a cause of contamination for the environment. In the hospital establishment, the contamination by excreta, although low, is almost unavoidable. In order not to introduce the notion of contamination accident in routine care, contamination of the environment by the patient must be considered as permanent. The mean external dispersion of radionuclides from the patient can be assessed for each type of diagnostic procedure. These dispersed radioactive substances may induce contamination of the personnel, either directly or, more weakly, through an indirect medium. The maximum risk of internal radiation is appreciated by adoption of a derived working limit corresponding to the most effective mode of contamination. In the case of a radionuclide primarily excreted by the urine, the maximum internal exposure shall be determined by whole body counting of a standard individual following a standard contact of his hands with a solution with a volume activity equivalent, for instance, to that of the urine eliminated during the first two hours following administration of that radionuclide. The internal radiation dose derived is to be multiplied by the fraction of total time spent at work, to compute the maximum internal radiation dose resulting for the personnel from the considered diagnostic procedure.

4.3. A hospital nursing team occupies a working area in which each of its members is usually in contact with a certain number of patients, for instance 15 to 20. This area is considered as a hospital sub-unit with regard to radiation protection. The rules pertaining to distribution of individual work generally involve for each member of the team an average of the same tasks with regard to every patient. This means that the maximum exposure per patient is to be summed for each person of the team considered.

## 5. Conclusion.

5.1. In order to avoid compulsory physical and medical controls, while complying with the optimal individual health rules, the ideal solution would consist in considering hospital workers as "adult workers not directly engaged in radiation work", and adopting the values of the corresponding maximum permissible individual dose recommended by the

e. 1.5 rem a year.

The control would thus be administrative and effected not as  
al monitoring but as a sub-unit survey.

imum number of various types of radionuclide investigations al-  
a sub-unit for each period of 13 consecutive weeks is adminis-  
y limited not to entail a computed individual dose higher than  
imum permissible dose of about 0.4 rem.

es of maximum computed, internal and external, doses to be  
re transmitted to the radiation safety officer of the nursing  
by the appointed radiation protection officer.

Since it is recommended to keep all doses as low as possible,  
cessary to organize a permanent information of the hospital  
to provide a signalization system of radioactive patients and  
op safety measures to avoid unnecessary exposure. The measures  
simple and are usually the same as those prescribed by the  
hygiene rules in force in hospitals.