

EXPOSITION CHRONIQUE D'UN GROUPE D'OUVRIERS AUX PEINTURES LUMINEUSES RADIO-ACTIVES. CONTRIBUTION À L'ÉTUDE DES EFFETS BIOLOGIQUES

V. TOMIN, M. TRAJKOVIĆ, D. VELJKOVIĆ, D. JANKOVIĆ, Z. UBOVIĆ,
B. PENDIĆ, Dj. BEK-UZAROV et Z. DJUKIĆ

Service de Protection Médicale, Institut des Sciences Nucléaires B. Kidrič, Vinča
(Yugoslavia)

Résumé—Un groupe d'ouvriers ayant travaillé au cours d'une longue période avec des peintures lumineuses radio-actives ont subi un examen médical au Service de Protection Médicale de l'Institut des Sciences Nucléaires "Boris Kidrič", Vinča. Compte tenu des conditions de travail, une contamination interne aux matières radio-actives a été possible.

Des examens cliniques et de laboratoires ont été faits sur les ouvriers cités ci-dessus afin de révéler si une contamination interne a eu lieu et de constater des altérations éventuelles y relatives.

Les résultats de ces examens (analyses radiotoxicologiques de l'urine, mesure de la radio-activité totale du corps, radiographie du squelette et autres) ont confirmé l'existence d'une contamination interne provoquée chez des ouvriers, qui, d'après l'anamnèse, ont été embauchés depuis longtemps au travail mentionné. Des altérations hématologiques dans le sang périphérique, décelées chez ces ouvriers, suggèrent une corrélation causale entre leur apparition et le temps d'exposition, ce qui nous renseigne, ainsi que d'autres constatations, sur le degré des contaminations internes dans l'organisme.

DISCUSSION

J. W. Ch. VAN STEEDEN (*Netherlands*):

Ich möchte Herr Nishiwaki fragen, in wie weit seine Ergebnisse Beziehung auf lebendes Gewebe haben.

Y. NISHIWAKI:

The sampling material used in these experiments was human skin, supplied by the Tokyo Metropolitan Medical Examiner's Office. Therefore, the skin was not living. The skin, of the size of about 3 by 15 cm with subcutaneous fat, was cut off from the central part of the breast of the adult at about 10 hr after accidental death and therefore under the conditions of the experiment we cannot expect any metabolic action.

Hub. WIJCKER (*Netherlands*):

What was the time lapse between contamination and the start of decontamination? Has the speaker some idea whether the contamination penetrated the skin and, if so, if it diffused back during the decontamination procedure.

Y. NISHIWAKI:

We have conducted these experiments about 1 hr after contamination of the skin surface and we have not tested to what extent contaminants were absorbed in the tissues. But we have conducted previous experiments on which we already reported during the Gatlinburg Conference. These experiments were done with other biological material and in this case we think that some of the absorbed nuclides may come out if we wash thoroughly with a running chelating solution. However, we had considerable differences in this type of experiment because the results may differ depending on the conditions of the decontamination. If these conditions are different, we cannot compare in a fair way the effectiveness of the different decontaminating materials. This is very difficult. Therefore we have designed the elaborate equipment to set these conditions at the time of the decontamination, so that experiments can be compared one to the other.

E. W. JACKSON (*U.K.*):

The curves you put on the screen, showing spectral distribution before and after decontamination showed a uniform degree of removal for each gamma energy and yet the experiments in which separate nuclides

were used showed a diversity of removal values. Are these two findings wholly consistent? Another point, could I have details of the pH of the contaminant used? As it is well known, to dissolve some of the fission elements requires strong acids. Did you apply strong acid solutions to the skin in this work?

I would also like to ask whether any fundamental study has been considered to determine the mode of attachment of some of the nuclides in a more simple form. Some years ago I did some laboratory experiments in which I determined the zeta potential at a solid-liquid boundary and I found that the degree of absorption, that is, the tightness in which nuclides were held, could be related to the zeta potential. I wonder if any work of this kind has been undertaken.

Y. NISHIWAKI:

The data appeared to be rather uniform, but the corresponding nuclides were estimated by Covell's method and after the estimation the results are indicated in the last slide which was shown at the end of my speech.

The pH of the solution was about 6.8. We wanted to conduct many series of experiments, but we had considerable difficulties in obtaining the skin material, so this may be considered only the beginning of the experiments. However, not to damage the surface of the skin, in this first series of experiments we tried to use solutions rather close to neutral. Therefore the pH which was measured before the start of the experiments was 6.8. Also about the zeta potential, we did not measure it, but we should like to obtain your paper, if this is possible later. Thank you very much for your remarks.

J. SHAPIRO (*U.S.A.*):

My question is actually addressed to either of the two speakers or to the audience. Some radiochemists I know when they have to decontaminate their fingers will use a skin stripping by using successive applications of adhesive to peel off the skin, of course not going to the base and removing the skin completely, but removing quite a bit. Or they use sand paper as a file to scrape away the contamination. I wonder whether the speakers have any comment on this method.

[*Dr. Stajić not having understood the question, Dr. Shapiro repeats as follows.*]

In discussing decontamination with radiochemists,

I found one, perhaps a very practical-minded individual, who got some cesium on his skin and he strips the top layers of his skin with successive applications of adhesive, just a few layers in order not to take the skin off, but enough to remove the surface activity; for the same purpose he used sand paper as a file, which is a dry method, a dry method without worry. Now, my question is, to the speakers who have used other methods, have they any comments on this approach?

Hub. WIJCKER:

The following information can be given concerning the peeling-off procedure for skin decontamination. This procedure has advantages if spreading of the contaminant by using solvents should be avoided. In the Kema labs there has not been need to use this procedure but in other labs in Holland some experience has been gained. Destruction of the granular layer has to be avoided (*stratum granulosum*) as this layer works as a barrier against penetration in many cases. More details can be found in my papers presented at the Euratom Symposia at Munich (1962) and Nice (1966).

J. STAJIĆ:

Nous avons protégé la peau de nos mains par la crème protectrice "Octa" et par des gants en caoutchouc.

P. M. BIRD (*Canada*):

I would like to ask either of the speakers if they have any experience of using ultrasonic techniques for removal of contamination from the hands.

J. STAJIĆ:

Non, nous n'avons pas essayé de méthode ultrasonique.

N. VALENTIN (*Belgium*):

L'auteur peut-il indiquer:

1. Si des études de dynamique de pénétration ont été faites avec d'autres composés chimiques du Cs^{137} que le chlorure, et dans ce cas, si des différences notables dans la vitesse de résorption transcutanée ont été constatées.

2. Quelle était, dans le cas du chlorure de Cs^{137} ,

l'acidité de la solution et s'il existe une relation entre l'acidité et la vitesse de résorption transcutanée.

B. PENDIĆ:

1. On a fait aussi des expériences avec une solution de nitrate. Nous avons observé que la pénétration de cette solution est moins grande que celle de la solution de chlorure.

2. On a expérimenté dans le travail présentement rapporté, seulement avec des solutions dont l'acidité était de 0, 1 N HCl.

K. KOREN (*Norway*):

I would like to ask Prof. Faber whether he has tried to evaluate the yearly absorbed dose to the liver from a given amount of injected thorostrast?

M. FABER:

Due to the inhomogeneous distribution of Thorostrast the dosimetry is difficult. Mean doses to organs have been calculated, but the significance of these figures is still undecided in relation to carcinogenesis.

F. WACHSMANN (*Germany*):

Da keine Angaben über die Höhe der lokalen Dosen nach der Anwendung von Thorostrast gemacht wurden, möchte ich angeben, dass ich mich erinnere von lokalen Dosen gehört zu haben, die hin zu 50 bis 100000 rad gehen! Halten Sie—Herr Faber—diese hohen Dosen für möglich?

M. FABER:

The dose around particles is not as high as suggested by the Chairman, but even so is not negligible.

H. KRIEDEL (*Germany*):

In neuerer Zeit sind verschiedentlich Mitteilungen über Schädigungen nach Anwendung von Peteosthor bei Kindern erschienen. Ich möchte Herrn Dr. Faber fragen, ob er darüber Erfahrungen besitzt.

M. FABER:

Peteosthor is a colloid preparation containing ^{224}Ra . It was used for bone diseases and tuberculosis. A certain number of bone tumours and leukemias have occurred in this group. It is known that German groups are tracing these children in order to evaluate the dose response relations.