REPOSITORY MMES/X-10/Vault
COLLECTION Central Files
BOX No. CF-44-11-719
FOLDER

SECRET

CENTRAL FILES NUMBER
44-11-719
11/16/44

Memo to: Dr. Dowdy
Re: Visit to Dr. Robley D. Evans

717367

Dear Dr. Dowdy:

Following are the notes I have made concerning our visit to Dr. Robley D. Evans at the Massachusetts Institute of Technology on November 15, 1944.

1. Excretion of radium from the human body.

Based upon present available evidence, Dr. Evans believes it probable that, of radium absorbed into the human body either through the lungs or the G. I. tract, 6 to 12 per cent remains in the body at the end of one year. Excretion beyond this time is low; perhaps not more than 50 per cent of the amount remaining at the end of the first year is excreted in the next 20 years. An accompanying photostat of a paper by Dr. Evans and co-workers, now in press in the American Journal of Roentgenology, gives similar data on rather short-term animal experiments.

Evidence based upon animal experiments indicates that a high calcium diet significantly decreases absorption of radium from the gastro-intestinal tract, but probably by not more than 20 to 50 per cent. The mechanism by which this is accomplished is not certainly known, but is probably related to the precipitation of radium in an insoluble form.

Within radium already in the body, periods of low calcium diet are a part of the therapeutic regime used to promote the excretion of radium.

Where exposure is to radium as dust, and where, therefore, the site of absorption is likely to be the lungs rather than the G. I. tract, Dr. Evans still feels that a good diet, high in calcium, is advisable, during the period of this exposure.

Dr. Evans believes that tracer experiments on human subjects, which he is sure would be absolutely without danger, can be expected to give much more reliable data on this subject.

2. Amount of absorbed radium tolerated by the human body:

An accompanying table from an unpublished paper by Drs. Aub, Martland, and Evans gives data on 24 patients whose bodies contained 20 micrograms or less of radium on examination, many years after exposure. One notes that no patient whose body contained 0.5 micrograms of radium or less has so far developed symtoms of radium poisoning. Four of these subjects, whose radium content at examination ranged from 0.3 to 0.5 micrograms, had their exposure more than 15 years ago.

Of seven patients with histories of exposure to radium more than ten years before examination and whose radium content

CLASSIFICATION CANCELLED
DATE JAN 24 1957
By Commission
Declassified by the Classification Branch

1120227
A-00195
Human Subjects Project

CR/Hoover, H. C.
Evans, R. D.
Radium

ranged from 0.9 to 5 micrograms, five have died or developed crippling lesions due to radium poisoning. These cases of clinically apparent radium poisoning include three containing 0.9, 1.1, and 1.5 micrograms of radium.

Dr. Evans suggests the tolerance value for radium fixed in the human body ought to be considered 0.1 micrograms. He admits the possibility that due to the magnitude of early excretion, the absorption of 5 to 10 times this amount may not be accompanied by great danger.

He points out the great difficulty, under actual manufacturing plant conditions, of being certain of the exact time in radium dosage and therefore, of the actual amount of excretion to be anticipated. According to Dr. Evans, the proposed N. Y. State code attempts to make distinctions of this sort, decreasing the amount of radium allowed in the bodies of dial painters over a period of three years. I have the impression that Dr. Evans believes there is a possibility of considerable variation in the ability of different humans to excrete radium, and that, therefore, there is a certain possibility of danger connected with the use of this code.

3. Efficacy of decalcification therapy in eliminating radium:

Dr. Evans believes that the methods described in his papers with Dr. Aub and others are of considerable use in promoting the excretion of recently absorbed radium. After radium has been fixed in the body for a year or more, this increased excretion, although measurable, does not significantly decrease the amount of radium left in the body, However, clinical improvement, in certain cases undergoing this treatment, is very great, and makes its use worthwhile even in old cases. One patient with necrosis of the jaw due to radium had complete repair, following treatment, and no recurrence since this treatment of several years ago. He suggests that radium is more easily mobilized from regions of active mineral metabolism in the bone, where damage is most likely to show up; conditions in these areas, therefore, may be considerably improved by treatments that do not remove more than 1 per cent of the radium from the body as a whole due to the extreme inertness of the great amounts of radium stored in such locations as the shafts of long bones.

4. Adequacy of breath radon measurements as indicators of radium content of the body.

The accompanying table (File 2242) indicates that, in ten patients, the percentage of radon, produced in the body, that escaped through the breath, varied from 32 to 56. The average value was 43.5; this is reasonably close to the figure of 45 per cent used in tolerance calculations.

5. Possible role of radiolead and its daughter, polonium, in radium poisoning.

It is possible that, in poisoning due to absorption of radium, aged 15 years or more since purification, the alpha activity of

1120228

polonium derived from radiolead may contribute as much as 30 per cent of the total ionization due to alpha particles. However, Dr. Evans believes this agent has probably not been important in recorded cases of radium poisoning.

6. Role of radon as opposed to radium-bearing dust in reported lung lesions.

Dr. Evans believes that all reported cases of carcinoma of the lung, directly attributable to exposure in the radium industry, are due to breathing radon rather than to deposits of radium in the lungs.

7. A basis for establishing a tolerance value for radium-containing dust in air.

Calculations made by Dr. Evans indicate that a concentration of 7×10^{-10} grams radium per cubic meter of air, if breathed 8 hours per day, 250 days a year, for 5 years, would leave in the body at the end of that time the order of 0.1 micrograms of radium.

8. Methods of detecting poisoning due to thorium and its daughter substances.

Dr. Evans states that cumbersome but reliable methods are available for determining thoron in either room air or breath samples. In principle, the breakdown products of thoron are collected on a charged disc and its radioactivity measured.

If I can be of any further help to you in preparing your report for Colonel Warren, will you please let me know.

Sincerely,

William F. Bale

Radium Patients Seen by Drs. Aub, Martland and Evans (1934-1944)

[redacted]

EXPOSURE	PATIENT	SEX	AGE	YEAR	At beginning of exposure: u-g. Ra	At latest measurement: Rn/Ra %	REMARKS
Drank radium water	[redacted]	F	48	1918	10	36	Extensive bone destruction, fractures (1943)
" " "	[redacted]	F			5		Sarcoma at knee. Died 1937.
Drank Radiothor	[redacted]	M	50	1927	10	(20)	Bone destruction, mandible; died 1939
" "	[redacted]	F	43	1926	3.8	(29)	No symptoms, 1944
" "	[redacted]	F	47	1927	0.1		No symptoms, 1936
Radium injections	[redacted]	M	37	1925	11.4	37	440- u-g Ra inj'd, ret'd 2.5% 15 yrs. Necrosis right mandible, 1938
" "	[redacted]	F	44	1924	20.4	43	Necrosis, mandible, 1934. Healed fol. parathormone treatm. Aub et al 1938
" "	[redacted]	F	55	1922	5.4	41	No symptoms, 1942
" "	[redacted]	F	18	1923	1.5	47	No symptoms, 1942
Radium chemist	[redacted]	M	24	1915	5		Died 1938. Lung carcinoma
" "	[redacted]	M	34	1913	0.4		No symptoms, 1939
" "	[redacted]	M	26	1902	0.3		No symptoms, 1943
" "	[redacted]	M	23	1912	0.3		No symptoms, 1943
Radium physicist	[redacted]	M	54	1936	0.3		No symptoms, 1938
Vet. Army Aviator	[redacted]	M	20	1917	0.01		No symptoms, 1940
" " "	[redacted]	M	20	1917	0.01		No symptoms, 1940
Vet. Army Aviator	[redacted]	M	20	1917	0.03		No symptoms, 1940
" " "	[redacted]	M	20	1917	0.02		No symptoms, 1940
Radium dial painter	[redacted]	F	15	1918	0.9	55	Radiation osteitis, deafness, frac'd femurs, chron. invalid (Martland '44)
Radium dial painter	[redacted]	F	16	1922	18	43	Tipped brush 7 yr. Died 1939, splenic leukemia, from renal insufficiency
" " "	[redacted]	F		1925	0.5		Tipped brush 3 yr. No clear symps. '35
" " "	[redacted]	F	20	1921	1.5		Tipped brush 5 yr. Died 1938 jaw tumor
" " "	[redacted]	F		1925	1.1	34	Tipped brush 3 yr. Extensive bone destruction 1941
[redacted] " " "	[redacted]	F	31	1924	2.5	32	Tipped brush 1 yr. Necro-

1120230

SECRET

Comments by Dr. Dowdy to accompany Dr. Bale's report of 16 November 1944 (Visit to Dr. Robley Evans)

It is my feeling that too little is known regarding the distribution of radium in the body in acute poisoning and the time required to fix the radium in inert cortical bone. Dr. Evans seems to feel that radium is more easily mobilized from points of more active mineral metabolism. He also feels that after a period of time, an equilibrium is established between the fixed radium and that found in the blood, and that if some method could be found to produce a higher percentage of elimination from the blood there would consequently follow a more rapid and complete elimination of the total radium stored in the body. This may or may not be so. Once radium isfixed in cortical bone, removal from the blood stream might not lead to additional release from such fixed stores.

The distribution of radium between the serum and cellular elements in circulating blood is not known. Perhaps one may presume considerable amounts in the cellular elements, otherwise one would expect a higher percentage of exfretion via the kidneys.

From a therapeutic standpoint it seems to me that in acute poisoning one might accomplish much be removing the radium by means of therapeutic blood replacement, especially if a considerable period of time were required to completely fix the the radium in cortical bone. Assuming that the average man has approximately 12 liters of blood volume, this could be completely replaced in 12 to 24 days' time. In chronic poisoning showing symptoms, "deleading" plus blood replacement might be sufficient to tide an individual over a crucial period. Unless radium can be mobilized from cortical bone, however, I see no way to prevent late bone necrosis or bone tumors by such a type of therapy.

Andrew H. Dowdy, M.D.

21 November 1944

SECRET

1120231