SERUM CHOLESTEROL AND IRRADIATION SICKNESS

BY

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The occurrence of sickness and other unfavourable reactions after treatment by x rays is no longer a major problem. Careful attention to ventilation, localization of the irradiation, and regulation of the intensity of each dose have very much reduced both the incidence and the severity of x-ray sickness. Nevertheless cases do still occur, and no satisfactory or conclusive explanation has yet been offered. They must obviously be of interest to anyone concerned with the general physiological and biochemical effects of irradiation. Symptoms caused by direct irradiation of the stomach or intestines are not under consideration here, and may obviously fall into a quite different category.

The extensive literature on this subject has been reviewed by Rolleston (1930-1), by Colwell and Russ (1924), and by Dodds and Webster (1924). Here it is only necessary to quote Levy-Dorn and Burgheim (1926) and Burgheim (1927). These authors observed in some cases a sharp fall of serum cholesterol after x-ray treatment, followed by vomiting. Cases not suffering from unfavourable symptoms showed no fall in serum cholesterol. Burgheim obtained good results by administering cholesterol as a preventive of x-ray sickness, and was therefore inclined to consider that a direct relation existed between the low level of serum cholesterol and the symptoms observed. Other authors have been unable to confirm these results.

The following series of cases may to some extent explain this discrepancy. The series is far too small to permit any conclusions to be drawn from it alone (war conditions make it very difficult to obtain further cases), but it may be of value when considered together with the work of Burgheim and of others.

The Present Investigation

The blood sera examined were obtained at the Mount Vernon Hospital, Northwood, with the kind collaboration of Dr. Perkins. Samples of blood were taken by her before irradiation and at the stated intervals afterwards. When it was necessary to keep the samples overnight she drew off the serum and stored it in the ice-chest. It was found that if whole blood is stored there may be a considerable loss of cholesterol.

Irradiation was carried out every day for a given period and the samples here estimated were taken before and after the first two irradiations of such a series. Where no sample was obtained before irradiation the approximate value was assumed to be that obtained in the sample twenty-four hours after irradiation, as these were often found to be the same. This twenty-four-hour sample is also the pre-irradiation sample for the second irradiation.

The method used was that of Leiboff (Peters and van Slyke, 1932). Table I shows that the most usual reaction to the first and often the second irradiation is a considerable rise in serum cholesterol. This rise was stressed by Burgheim, who considered it (personal communication) to be due to cholesterol leaving the tumour after irradiation.

Table II shows that an increase of serum cholesterol did not appear in four cases in which vomiting occurred, but that there was actually a considerable fall. To this

TABLE I

Case	Site	Cholesterol (mg. per 100 c.cm. of serum)			
		Before 1st Irradiation	5 Hours After	Before 2nd Irradiation (24 Hours After 1st)	5 Hours After
P.	Uterus ..	115	200	130	143
C.	Pelvis ..	110	208		
S.	Breast ..	50		50	140
A.	Oesophagus ..		40	34	59
M.			107	61	160
W.	Breast ..	80	53		53
D.	Vulva ..		86	113	125

TABLE II

Case	Site	Cholesterol (mg. per 100 c.cm. of serum)			
		Before 1st Irradiation	5 Hours After	Before 2nd Irradiation (24 Hours After 1st)	5 Hours After
B.	Uterus ..	100	60		
F.	"	143	Vomiting 69	140. Vomiting	62 Vomiting 83
K.	Dorsal spine	200	200 Vomiting 67		
N.	Left thigh		Slight vomiting	78	66

extent these figures agree with the result obtained by Burgheim. It will be noticed, however, that there is not necessarily any direct relation between the fall in the serum cholesterol level and the onset of the symptoms. In Case K., for instance, the fall in cholesterol did not occur until after the second irradiation, whereas the vomiting began after the first irradiation, and in Case F. there was still vomiting nearly twenty-four hours after the first irradiation, when the cholesterol value had returned to normal. In Case N. the change was far too small to account for any symptoms; Case W. in Table I, in which no vomiting occurred, showed a slightly greater fall. Other isolated observations—not included in the tables, as they are single estimations and not a series on each case—serve to support the view that there is no direct relation between the serum cholesterol level and the symptoms after irradiation. Thus the serum cholesterol of patients on admission shows very wide variation, being sometimes present in minute traces only. Again, in three cases samples taken shortly after vomiting show normal or even high cholesterol values.

In conclusion it can be said, taking these few cases together with those of Burgheim, that in patients liable to x-ray sickness there may be a tendency for the serum cholesterol level to fall. Any direct relation between the amount of cholesterol in the serum and the symptoms observed, or any definite time-relation between the two, cannot be substantiated, this probably accounting for the fact that some workers have not confirmed the results of Burgheim. It may well be that some factor concerned with the production of the symptoms tends also to produce a change in metabolism leading to a loss of cholesterol from the blood.

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The Medical Society of New Jersey, founded in 1766, is the oldest medical society in the United States. Then come Massachusetts (1781), Delaware (1789), New Hampshire (1791), Connecticut (1792), Maryland (1798), and New York (1806) in the order named.