

LETTER TO THE EDITORS

Consideration for the treatment of mass casualties based on pathology of the fatalities of Hiroshima and Nagasaki

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Sirs: We have reviewed the autopsy materials ‘Pathology of atomic bomb casualties’ (Leibow et al. 1949) and ‘Medical effects of the atomic bomb in Japan’ (Oughterson and Warren 1956). To some degree the cause of death to the casualties of

Hiroshima and Nagasaki was similar to the cause of death from any massive explosion associated with blast injuries, heat (burns), and trauma from collapsing buildings, etc. As it has been well established, the effect of radiation, however, triggered a whole

Table I. Important anatomic changes in severe ‘Radiation Effect’.

Tissue	Group I	Group II*	Group III [†]
	Patients dying in weeks 1 and 2	Patients dying in weeks 3, 4, 5, 6	Patients dying after week 6
Adipose tissue	Usually no depletion	Occasionally depletion	Usually depletion
Lung	Occasional hemorrhage and edema	Necrosis and hemorrhage	Focal necrotising or organising pneumonitis
Bone marrow	A. Hypoplasia	Usually A. Hypoplasia Occasionally B. Marked reticulum hyperplasia C. Focal myeloid Re-generation D. Marked myeloid hyperplasia	Usually C. Focal myeloid regeneration D. Marked myeloid hyperplasia Occasionally A. Hypoplasia B. Marked reticulum hyperplasia
Lymph nodes and spleen	Extreme decrease of small lymphocytes	As in group I, and atypical mononuclear cells	As in group II, and occasionally regeneration of lymphoid tissue
Gastro-Intestinal tract	Atypical mitotic figures and epithelial cells	Necrosis, hemorrhage, and ulceration	Necrosis and ulceration
Neck organs	Atypical mitotic figures and epithelial cells	Necrosis, hemorrhage, and ulceration	Focal necrosis and ulceration
Skin	Unknown	Petechiae and necrosis, atrophy of hair follicles	Regeneration of hair follicles; usually no other changes
Gonads (especially testis)	Incipient atrophy	Severe atrophy	Extreme atrophy

*No polymorphonuclear cells in lesions.

[†]Polymorphonuclear cells in lesions.

No distinction is made in this table between the direct effects of ionising radiation and the indirect effects resulting from infection, etc. (Reproduced from Am J Pathol 1949, 25:853–1027 with permission from the American Society for Investigative Pathology).

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new panorama of injuries. Radiation sickness produced nausea, vomiting, dehydration as well as destruction of the patient's bone marrow and lymphoid tissue.

Most of the illness and death that occurred after two weeks was the direct and indirect effect of a compromised immune system (Table I). The pathologists evaluating the autopsy materials noted that around two weeks after the explosion, there was a drop in the death rate for about 5 days and then a rise again. They also noted that this rise could be due to 'patients' pre-existing injuries'. The partial recovery, noted in the autopsies of the bone marrow of the patients, did not occur 40–50 days after the explosion. The compromised immune system, and the lack of antibiotics, resulted in infection, poor healing, ulceration, hemorrhage, pneumonia, and death. There is every reason to believe that if antibiotics can protect the patients until the marrow recovers, such adverse effects would be reduced.

The pathologists of The Joint Commission, who began evaluating the autopsy materials only six weeks after the explosion, suggested at the end of their study that only 5–10% of the deceased could have been saved. However, the only antibiotics available to the Japanese physicians at the time of the explosion were sulfa compounds used in low doses. In their conclusion, the pathologist noted: 'pending the resurrection of the bone marrow, the main therapeutic problems are those of hemorrhage and infection'.

From a review of the pathological materials described in the report (Leibow et al. 1949), the casualties could potentially have been treated with marrow replacement and antibiotics. The current availability of advanced antibiotics and human cord blood for marrow replacement from the National Cord Blood depositories, coupled with readily available intravenous fluids, would, in our opinion, save 80–90% of those who survive the first 72 hours following an accidental or intentional nuclear detonation. In addition, the long-term effects of radiation could be mitigated. This would require, however, hundreds of volunteers to administer fluids and an organised coordinated plan. Currently, such a national large scale coordinated plan does not exist.

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