



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

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3 **Letter to the Editors**  
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6 **Consideration for the treatment of mass casualties based on pathology of the fatalities of**  
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8 **Hiroshima and Nagasaki**  
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12 Dear Editors,  
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15 We have reviewed the autopsy materials “Pathology of Atomic Bomb Casualties” (Leibow et al.  
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17 1949) and “Medical Effects of the Atomic Bomb in Japan” (Oughterson and Warren 1956). To  
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19 some degree the cause of death to the casualties of Hiroshima and Nagasaki was similar to the  
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21 cause of death from any massive explosion associated with blast injuries, heat (burns), and  
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23 trauma from collapsing buildings, etc. As it has been well established, the effect of radiation,  
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25 however, triggered a whole new panorama of injuries. Radiation sickness produced nausea,  
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27 vomiting, dehydration as well as destruction of the patient’s bone marrow and lymphoid tissue.  
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31 Most of the illness and death that occurred after two weeks was the direct and indirect  
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33 effect of a compromised immune system (Table I). The pathologists evaluating the autopsy  
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35 materials noted that around two weeks after the explosion, there was a drop in the death rate for  
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37 about 5 days and then a rise again. They also noted that this rise could be due to “patients’ pre-  
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39 existing injuries”. The partial recovery, noted in the autopsies of the patient’s bone marrow, did  
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41 not occur until 40 – 50 days after the explosion. The compromised immune system, and the lack  
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43 of antibiotics, resulted in infection, poor healing, ulceration, hemorrhage, pneumonia, and death.  
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45 There is every reason to believe that if antibiotics can protect the patients until the marrow  
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47 recovers, such adverse effects would be reduced.  
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53 The pathologists of The Joint Commission, who began evaluating the autopsy materials  
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55 only 6 weeks after the explosion, suggested at the end of their study that only 5 -10 % of the  
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57 deceased could have been saved. However, the only antibiotics available to the Japanese  
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3 physicians at the time of the explosion were sulfa compounds used in low doses. In their  
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5 conclusion, the pathologist noted: “pending the resurrection of the bone marrow, the main  
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7 therapeutic problems are those of hemorrhage and infection.”  
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10 From review of the pathological materials described in the report (Leibow et al. 1949),  
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12 the casualties could potentially have been treated with marrow replacement and antibiotics. The  
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14 current availability of advanced antibiotics and human cord blood for marrow replacement from  
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16 the National Cord Blood depositories, coupled with readily available intravenous fluids, would,  
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18 in our opinion, save 80 to 90% of those who survive the first 72 hours following an accidental or  
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20 intentional nuclear detonation. In addition, the long term effects of radiation could be mitigated.  
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22 This would require, however, hundreds of volunteers to administer fluids and an organized  
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24 coordinated plan. Currently, such a national large scale coordinated plan does not exist.  
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Oughterson AW, Warren S. 1956. Medical Effects of the Atomic Bomb in Japan (National nuclear energy series. Manhattan Project Technical Section. Division VIII, v.8). New York: McGraw-Hill.

Table I

## Important Anatomic Changes in Severe "Radiation Effect"

Tissue	Group I Patients dying in weeks 1 and 2	Group II* Patients dying in weeks 3, 4, 5, 6	Group III* Patients dying after week 6
Adipose tissue Lung	Usually no depletion Occasional hemorrhage and edema	Occasionally depleted Necrosis and hemorrhage	Usually depletion Focal necrotizing or organizing pneumonitis
Bone marrow	A. Hypoplasia	Usually A. Hypoplasia Occasionally B. Marked reticulum hyperplasia C. Focal myeloid regeneration 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 ionizing 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)