

frequent shocks arising from vibrations set going by the manipulation of pneumatic tools. The bony changes included extensive modifications of the articular surfaces, vacuoles in the head of the radius, numerous osteophytes around the joint and ossifications in the triceps tendon. There was some limitation in movement, but no clinical symptoms. An explanation of the lesions is difficult to suggest.

-- Bull. Hyg.

RADIOACTIVITY AND X-RADIATION

- 261 Problems Associated with the Application of External and Internal Radiation Exposure Limits. K. Z. Morgan. *Am. Ind. Hyg. Assn. Quart.* 16, 307-323 (Dec. 1955).

This paper is an extensive discussion of the many problems to be solved in order to establish adequate limits for exposure of persons to various forms of radiation externally and internally. The limitations of the use of the roentgen and other units are discussed. Basic and other criteria of permissible exposure are stated. The general types of experimental data needed to establish reliable maximum permissible exposure values are discussed at length. One need is experimentation on human volunteers. One source of data is that furnished from accidents or military operations, but such data, for instance from the tests in the South Pacific, are incomplete. Analyses of the distribution of radiation among the bodily organs are being made on the bodies of persons who have died from violence. It will require many years to establish reliable values from both animal and human experiments and from soil and water analysis, but this should not discourage present investigations or delay others that are contemplated. A number of administrative problems are discussed.

- 262 Radiation Hazards to Nonradiologists Participating in X-Ray Examinations. M. Rivo, G. J. D'Angio, and I. E. Rhodes. *J. Am. Med. Assn.* 160, 4-10 (Jan. 7, 1956).

Injuries to physicians continue to occur because of the increasing use of x-rays and gamma radiation in modern diagnosis. The danger to nonradiologists is especially great until they learn to practice safety habits and to use available protective equipment. The survey here reported revealed poor safety habits in most nonradiological personnel and resulted in striking improvement. In the past, fluoroscopic reduction of fractures was the commonest cause of injury. Highly malignant forms of carcinoma developed in the skin, but damage to the hemopoietic and reproductive organs has also been serious. New procedures such as cystourethrography, angiography, myelography, and hip-nailing are here analyzed as to the amount of exposure involved; and the methods needed for protection are described.

-- Editor's summary

- 263 Late Follow-Up Studies after Internal Deposition of Radioactive Materials. W. B. Looney and M. Colodzin. *J. Am. Med. Assn.* 160, 1-3 (Jan. 7, 1956).

Sources of material for defining the safe levels of radioelements in the body include: persons given radium salts for therapy during 1915-1930; employees of luminous-dial factories before adequate safety measures were taken; and patients given radiologic examinations with thorotrast from about 1930 to 1945. Many of these persons are still living. Radium is deposited in the skeleton in small areas of high concentration. Malignant tumors and roentgenographic changes and symptoms resulting from increased fragility of the skeleton may occur many years after deposition. Thorium is deposited in the reticuloendothelial system and remains throughout the life of the patient. The major sites of deposition are the liver, spleen, and bone marrow. Increased density of the liver and spleen are usually found on roentgenographic examination. Induration and contraction may be present at the sites of injection in the neck and arms. A small number of primary hepatic tumors, leukemias, and hematological disorders have been found. These results warrant further studies of large numbers of patients. (The number of the disorders is significant when compared to suitable control groups.)

-- Cond. from authors' summary