

# BONE

- Treatment of cancers in the oral region often includes irradiation of the mandible.
- “Osteoradionecrosis“ is the most serious clinical complication that occurs in bone after irradiation. The decreased vascularity of the mandible renders it easily infected by microorganisms from the oral cavity.
- This bone infection may result from radiation-induced breakdown of the oral mucous membrane, by mechanical damage to the weakened oral mucous membrane such as from a denture sore or tooth extraction, through a periodontal lesion, or from radiation caries.
- This infection may cause a nonhealing wound in irradiated bone that is difficult to treat.

- The risk for osteoradionecrosis and infection can be minimized by removing all poorly supported teeth, allowing sufficient time for the extraction wounds to heal before beginning radiation therapy, and adjusting dentures to minimize the risk for denture sores.
- When teeth must be removed from irradiated jaws, the dentist should use atraumatic surgical technique to avoid elevating the periosteum, provide antibiotic coverage.
- Often patients require a radiographic examination to supplement the clinical examination. These radiographs are especially important because untreated caries leading to periapical infection can be quite severe with the compromised vascular supply to bone.

# EFFECTS OF WHOLE-BODY IRRADIATION

- When the whole body is exposed to low or moderate doses of radiation, characteristic changes (called the acute radiation syndrome) develop.

- **ACUTE RADIATION SYNDROME:**

The acute radiation syndrome is a collection of signs and symptoms experienced by persons after acute whole-body exposure to radiation.

**PRODROMAL PERIOD:**

Within the first minutes to hours after exposure to whole-body irradiation of about 1.5 Gy, symptoms characteristic of gastrointestinal tract disturbances may occur.

The individual may develop anorexia, nausea, vomiting, diarrhea, weakness, and fatigue. These early symptoms constitute the prodromal period of the acute radiation syndrome.

- **LATENT PERIOD :**

After this prodromal reaction comes a latent period of apparent well-being, during which no signs or symptoms of radiation sickness occur. The extent of the latent period is also dose-related.

It extends from hours or days after supralethal exposures (greater than approximately 5 Gy) to a few weeks at sublethal exposures (less than 2 Gy).

# HEMATOPOIETIC SYNDROME

- Whole-body exposures of 2 to 7 Gy cause injury to the hematopoietic stem cells of the bone marrow and spleen.
- Doses in this range cause a rapid and profound fall in the numbers of circulating granulocytes, platelets, and finally erythrocytes.
- The clinical signs of the hematopoietic syndrome include infection (in part from the lymphopenia and granulocytopenia), hemorrhage (from the thrombocytopenia), and anemia (from the erythrocyte depletion).
- Because periodontitis results in a likely source of entry for microorganisms into the bloodstream, the role of the dentist is important in preventing infection in hematopoietic syndrome.
- The removal of sources of infection, the vigorous administration of antibiotics, and in some cases the transplantation of bone marrow have saved individuals suffering from the acute radiation syndrome.
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# CARDIOVASCULAR AND CENTRAL NERVOUS SYSTEM SYNDROME

- Exposures in excess of 50 Gy usually cause death in 1 to 2 days. The few human beings who have been exposed at this level showed collapse of the circulatory system with a precipitous fall in blood pressure in the hours preceding death.
- Autopsy revealed necrosis of cardiac muscle. Victims also may show intermittent stupor, incoordination, disorientation, and convulsions suggestive of extensive damage to the nervous system .
- Symptoms most likely result from radiation induced damage to the neurons and fine vasculature of the brain.

# RADIATION EFFECTS ON EMBRYOS AND FETUSES

- Exposures in the range 2-3Gy during the first few days after conception are thought to cause undetectable death of the embryo .
- The cells in the embryo are dividing rapidly and are highly sensitive to radiation.
- Lethality is common and many of these embryos fail to implant in the uterine wall.

# STOCHASTIC EFFECTS

- **CARCINOGENESIS**

- Radiation causes cancer by modifying the DNA. Although most such damage is repaired, imperfect repair may be transmitted to daughter cells and result in cancer.
- Most likely the basis is radiation-induced gene mutation. Most investigators believe that radiation acts as an initiator, that is, it induces a change in the cell so that it no longer undergoes terminal differentiation.
- Evidence also exists that radiation acts as a promoter, stimulating cells to multiply. Finally, it may also convert premalignant cells into malignant ones.



**BOX 2-2**  
***Susceptibility of Different Tissues to  
Radiation-Induced Cancer***

HIGH	MODERATE	LOW
Colon	Breast (women)	Bladder
Stomach	Esophagus	Liver
Lung		Thyroid
Bone marrow (leukemia)		Skin
		Bone surface
		Brain
		Salivary glands

# THYROID CANCER

- The incidence of thyroid carcinomas (arising from the follicular epithelium) increases in human beings after exposure. Only about 10% of individuals with such cancers die from their disease.
- Susceptibility to radiation-induced thyroid cancer is greater early in childhood than at any time later in life, and children are more susceptible than adults.
- Females are 2 to 3 times more susceptible than males to radiogenic and spontaneous thyroid cancers.

# BRAIN AND NERVOUS SYSTEM CANCERS

- Patients exposed to diagnostic x-ray examinations in utero and to therapeutic doses in childhood or as adults (average midbrain dose of about 1 Gy) show excess numbers of malignant and benign brain tumors

# SALIVARY GLAND CANCER

- The incidence of salivary gland tumors is increased in patients treated with irradiation for diseases of the head and neck, in Japanese atomic bomb survivors, and in persons exposed to diagnostic x radiation.
- An association between tumors of the salivary glands and dental radiography has been shown, the risk being highest in persons receiving full-mouth examinations before the age of 20 years.

## CANCER OF OTHER ORGANS

- Other organs such as the skin, paranasal sinuses, and bone marrow (with respect to multiple myeloma) also show excess neoplasia after exposure. However, the mortality and morbidity rates expected after head and neck exposure are much lower than for the organs described previously.
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# HERITABLE EFFECTS

- These are changes seen in offspring of irradiated individuals.
- They are the consequences of damage to genetic materials of reproductive cells.

## • DOUBLING DOSE

- One way to measure the risk from genetic exposure is by determining doubling dose .
- It is the amount of radiation requires to produce in the next generation as many additional mutations are arise spontaneously

**THANK YOU**