CLINICAL MANAGEMENT OF RADIATION EXPOSURE

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UNIQUE FEATURES AND POTENTIAL IMPACTS

- PUBLIC FEAR OF RADIATION
- POTENTIAL FOR PHYSICAL INJURY AND DEATH BEYOND INITIAL EVENT
- INVISIBLE CONTAMINANT WITH NO CLEAR BOUNDARY
- NMR, NUCLEAR LAB

TYPES OF IONIZING RADIATION

- PARTICLES OR WAVES

- PARTICles
  Alpha, beta, neutrons

- ELECTROMAGNETIC WAVES
  gamma and X-rays

PENETRATION

- ALPHA - MASSIVE PARTICLES - LITTLE PENETRATION
- BETA - LIGHT PARTICLE - “B” BURN
- GAMMA - SIMILAR TO X-RAYS
- NEUTRONS - UNCHARGED - EMITTED DURING NUCLEAR DETONATION CAN CAUSE SEVERE DAMAGE

DAMAGE TO CELLS

- RADIATION INTERACTS WITH ATOMS - RESULTS IN ELECTRON EXCITATION
- DNA IS DAMAGED

A. ENERGY MAY DIRECTLY KILL CELLS

OR

B. ENERGY DEPOSITED IN WATER MOLECULES OF BODY PRODUCES TOXIC HYPEROXIDE MOLECULES.

DAMAGE TO CELLS (CONT.)

- RADIOSENSITIVITY

- VULNERABLE TISSUES
  - HEMATOPOIETIC
  - GASTROINTESTINAL
  - REPRODUCTIVE SYSTEM

UNITS OF MEASURE

- RAD OR GRAY - UNITS OF ABSORBED DOSE - AMOUNT OF ENERGY DEPOSITED IN RADIATION MATTER.
- REM - SIEVERT - DOSE EQUIVIDENT - BIOLOGIC EFFECT ON SPECIFIC MATTER BY RADIATION TYPE

UNITS OF MEASURE (CONT'D)

- BETA, X-RAY + GAMMA RADIATION
  - ABSORBED DOSE = DOSE EQUIVALENT
- ALPHA RADIATION
  - DOSE EQUIVALENT IS 20 TIMES ABSORBED DOSE

1 Gray (Gy = 100 RAD.
1 Sievert (Sv) = 100 REM

EVERYDAY RADIATION

- NATURAL COSMIC - 60 mrem/year
- NATURAL RADIOACTIVITY - 40 mrem/year
- AIR TRAVEL - LONDON TO NY - 4 mrem
- CHEST X-RAY - 10 mrem
- RADON IN HOME - 200 mrem/year
- DIAGNOSTIC MEDICINE - 60 mrem/year

TYPE OF RADIATION EXPOSURE

- EXTERNAL IRRADIATION
- CONTAMINATION
  - External
  - Internal
- INCORPORATION

BIOLOGICAL EFFECTS

- 50mGy (5 rads) - NO INJURY
- 1Gy - NAUSEA, VOMITTING
- 3.5Gy - NAUSEA, VOMITTING - PANCYTOPENIA
- HIGHER LEVELS - FATAL

LETHAL DOSE

- LD 50/60 - 4.5 Gy
- WITH MINIMAL TREATMENT - LD 50/60 - 3.4 Gy
- CHERNOBYL - LD 50/60 - 6Gy
- MAY BE POSSIBLE TO RAISE LD 50/60 TO 11Gy

ACUTE RADIATION SYNDROME

ACUTE ILLNESS CAUSED BY WHOLE BODY RADIATION OVER A SHORT PERIOD OF TIME (IN EXCESS OF 2 Gy).

ARS PREDICTABLE COURSE

- PRODROMAL PHASE
- LATENT PHASE
- MANIFEST ILLNESS PHASE
- RECOVERY OR DEATH

SYSTEMS AFFECTED

- HEMATOPOETIC
- G.I. SYNDRONE
- CARDIOVASCULAR AND CNS

ARS PATIENT MANAGEMENT STRATEGIES

- TREATMENT OF LIFE THREATENING INJURIES TAKES PRECEDENCE OVER MEASURES TO ADDRESS RADIOACTIVE CONTAMINATION OR EXPOSURE

ARS PATIENT MANAGEMENT INITIAL STRATEGIES

- VOMITING – USE SELECTIVE BLOCKING OF SEROTONIN 5- HT3 RECEPTERS
- CONSIDER :
  - INTIATING VIRAL PROPHYLAXIS
  - TISSUE / BLOOD TYPING
  - PROMPT HEMATOLOGIST AND RADIATION CONSULTS

ARS PATIENT MANAGEMENT INITIAL STRATEGIES

- DRAW BLOOD FOR:
  - CBC WITH PLATLETS
  - ABSOLUTE LYMPHOCYTE COUNT
  - HLA TYPING
  - CHROMOSOME ANALYSIS

ARS PATIENT MANAGEMENT INITIAL STRATEGIES

- SUPPORTIVE CARE IN A CLEAN ENVIRONMENT – REVERSE ISOLATION
- STIMULATION OF HEMATOPOIESIS – USE OF GROWTH FACTORS (IL 11)
- STEM CELL , PLATLET, BONE MARROW TRANSFUSION

ARS PATIENT MANAGEMENT

COLLECT VOMITUS, URINE, FECES, GASTRIC LAVAGE FLUID IN APPPROPRIATE CONTAINERS TO EVALUATE DOSE RECEIVED

PREVENTION OF INFECTION

- LOW MICROBIAL CONTENT FOOD
- ACCEPTABLE WATER SUPPLY
- FREQUENT HANDWASHING OR GLOVES
- AIR FILTRATION
- PROPHYLATIC ANTIBIOTICS – SUPPRESS AEROBES
  PRESERVE ANAROBES
- PROSTAGLANDIN ANALOGS - MAY PREVENT GASTRIC HEMORRHAGE
- EARLY ORAL FEED

LOCAL RADIATION INJURY

- MAJORITY OF RADIATION ACCIDENTS
- RARELY CAUSES SYSTEMATIC SYMPTOMS
- ERYTHEMA, HYPERESTHESIA
- EPILATION, DESQUAMATION AND NECROSIS
- *BETA-PARTICLE* CONTAMINATED BURNS NEED EARLY VIGOROUS DECONTAMINATION, AND MAY REQUIRE EXCISION FOLLOWED BY GRAFTING