UNITED STATES MARINE CORPS

FIELD MEDICAL TRAINING BATTALION
Camp Lejeune, NC 28542-0042

FMST 305

Manage Radiological Warfare Casualties

TERMINAL LEARNING OBJECTIVE

1. Given a casualty and the absence of a CBRN team, necessary medical equipment and supplies, **manage CBRN injuries to prevent further injury or death within the scope of care**. (HSS-CBRN-2007)

ENABLING LEARNING OBJECTIVES

1. Without the aid of reference and in writing, **identify the procedures for treating radiological warfare casualties**, within 80% accuracy, per the Medical Management of Radiological Casualties, current edition. (HSS-CBRN-2007c)

1. **FOUR TYPES OF NUCLEAR BLASTS** (See figure 1)

High Altitude Burst

Characteristics

- Detonation of a weapon at an altitude **above 100,000 ft.**
- Fireball is much larger and expands much more rapidly than a surface or subsurface burst.
- Ionizing radiation can travel for hundreds of miles before being absorbed.
- Causes severe disruption in communication and leads to an electromagnetic pulse (EMP), which can significantly degrade or destroy electronic and critical medical equipment.

Air Burst

Characteristics

- An explosion in which a weapon is detonated at an altitude **below 100,000 feet but** high enough that the fireball does not contact the surface of the earth.
- Airbursts may cause considerable damage; thermal burns to exposed skin may be produced many kilometers away from the burst.
- Eye injuries may be produced at even a much greater distance than that of thermal burns.
- Tactically, airbursts are the most likely to be used against ground forces.

Surface Burst

Characteristics

- An explosion in which a weapon is detonated on or slightly above the surface of the earth so that the fireball actually touches the land or water surface.
- The area affected by the blast, thermal radiation, and initial nuclear radiation will be less extensive than an air burst of similar yield.
- It produces the greatest amount of fallout over a much larger area than that which is affected by blast and thermal radiation.

Subsurface Burst

Characteristics

- An explosion in which the point of detonation is beneath the surface of land or water.
- Cratering of the ground will generally result.
- If the subsurface burst does not penetrate the surface, the only other hazard will be from ground or water shock.
- If the burst is shallow enough to penetrate the surface, blast, thermal and initial nuclear radiation effects will be present, but less than a surface burst of comparable yield.
- If the burst penetrates the surface, fallout will be heavy.

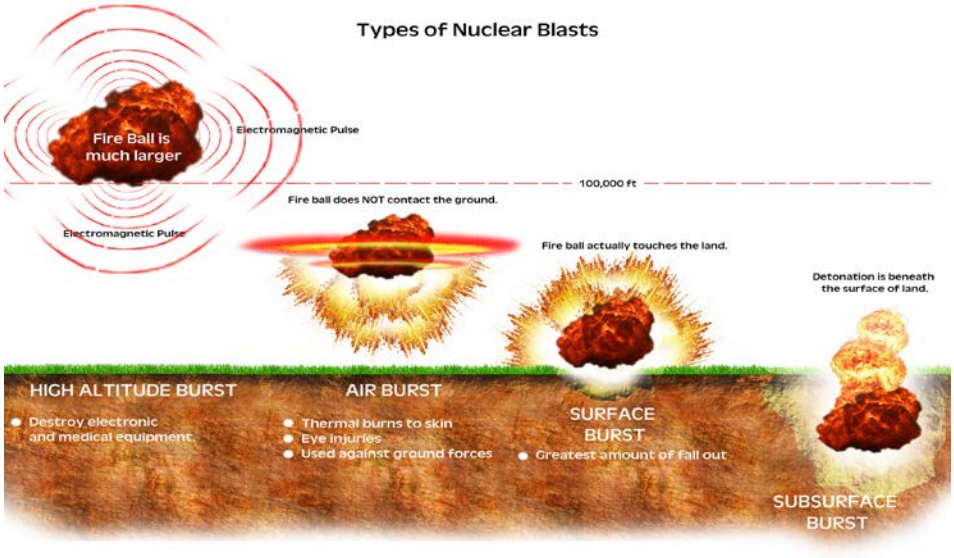

Figure 1. Types of Nuclear Blasts

2. COMMON TYPES OF NUCLEAR INJURIES

Two Types of Blast Injuries:

Although there are many effects of a standard blast (see block 4 "Blast Injuries") the following information divides the types of injuries that may result from a nuclear explosion into two types, primary and secondary.

Primary Blast Injury (Direct) - these types of injuries are caused by the direct action of the shock wave on the human body after the detonation of a nuclear device.

- Injuries occur immediately after detonation due to over pressure from the rapid expansion of air.
- If the patient is in close proximity to ground zero, the initial blast wave is usually lethal.
- Sub-lethal exposures to the initial blast wave can result in damage to bones, muscles, lungs, gastrointestinal system and ruptured eardrums.

Secondary Blast Injury (Indirect) - these injuries are caused by indirect wind forces greater than several kilometers per hour seconds after the primary detonation of a nuclear device.

- Injuries occur as a result of collapsing buildings, flying timber and other debris impacting the body or physical displacement of the body against objects or structures.
- More injuries are caused by indirect blast wind drag forces than by the shock wave.

Treatment of Blast Injuries from a Nuclear Attack:

Blunt trauma - blunt trauma with nuclear detonation will be anywhere from mild to severe. Injuries occur as a result of debris put into motion from blast and its following winds. Injuries such as fractures, spinal injury, head and torso blunt trauma, and penetrating injuries should be expected. Care for these injuries as you would in a non-contaminated environment.

Pressure Trauma - the greatest concern with pressure trauma is injury to the lungs. Damage to the alveoli causes swelling, fluid accumulation, and possibly pulmonary emboli. Pulmonary embolism occurs as a result of air escaping the damaged lungs directly into the bloodstream. Treatment of suspected pressure trauma to the lungs includes:

- 100% oxygen, positive pressure if needed.
- If pulmonary embolus is suspected, place the patient on their left side to slow down the movement of the emboli.

The five acknowledged nuclear powers possess about ***31,000 nuclear warheads***. India has not formally placed their nuclear arsenal on a delivery system. Pakistan has.

Thermal Injuries from a Nuclear Attack - thermal radiation emitted by a nuclear detonation causes two types of burns:

Flash Burns (Direct)

Flash Burns results from thermal radiation (infrared) emanating from the fireball of a nuclear explosion. Exposed skin and extremities facing the explosion will be burned

Flame Burns (Indirect)

Flame burns are caused by exposure to fires from the environment, particularly from ignition of clothing. This could be the predominant cause of burns depending on the number of and characteristics of flammable objects in an environment.

Eye Injuries: the initial thermal pulse from nuclear detonation can cause eye injuries in the form of flash blindness and retinal scarring

Flash blindness

Flash blindness results from looking in the general direction but not directly at a brilliant flash of intense light energy. It is a condition in which a flash of light swamps the eyes and depletes the pigmentation from the retinal receptors. Flash blindness is a temporary condition that usually last for several seconds but not more than two minutes when exposure occurs during daylight. The blindness will be followed by a darkened after image that lasts for several minutes. If exposure occurs at nighttime, blindness can last from 15 to 30 minutes before full nighttime adaptation occurs.

Retinal Scarring

Retinal Scarring develops from a burn to the retina from looking directly at the fireball. It is a relatively uncommon injury, but can cause blind spots and permanent blindness.

3. **DIAGNOSIS OF LEVELS OF EXPOSURE**

Radiation Absorbed Dosage (RAD) - the method for measuring radiation dosage. Accurate and prompt diagnosis of a casualty is based primarily upon the clinical picture presented by the individual.

Mild - vomiting **does not occur by the end of the fourth** hour after exposure.

Severe - vomiting **within two** hours.

Deadly - vomiting **within the first** hour accompanied by **explosive diarrhea.**

4. **SIGNS AND SYMPTOMS OF RADIATION EXPOSURE**

90% of those exposed to a significant dose of ionizing radiation will exhibit the following symptom within **two to six** hours after exposure:

- Nausea
- Vomiting
- Diarrhea
- Fatigue
- Hyperthermia (rise in body temperature)
- Erythema (reddening of the skin)
- Hypotension
- Neurological Dysfunction
- Malaise (mental confusion, convulsion, coma)
- Anorexia (loss of appetite)

5. **TREATMENT FOR RADIATION EXPOSURE**

Treatment for radiation casualties with no physical injuries is supportive in nature.
Treatment for radiation exposure is based on managing life threatening injuries, burns, blunt trauma, controlling hemorrhage, pressure trauma, and the signs and symptoms displayed, not on the amount of radiation received.
Pain management - morphine is the drug of choice. It should be given in doses of 10mg (auto-injector) every 4-6 hours.
Infection - administer antibiotics prophylactically to manage any infection after radiation. Choose one broadly active against gram-negative aerobic bacteria such as Cipro or levofloxacin. Include one for gram-positive bacteria where these organisms are prevalent. Consider prophylactic antibiotic coverage for skin flora if burns are present. Include a prophylactic antifungal such as fluconazole and an antiviral such as acyclovir. You will need to use 3 times the normal dosage. Normal recovery time is from 8 to 15 weeks.

6. **PERSONNEL PROTECTION MEASURES**

In a tactical environment, the following are immediate protective measures to observe during a surprise nuclear attack:

- Drop flat on the ground, face down, with head toward blast if possible or to the bottom of your fighting hole.
- Close your eyes and don't look at the explosion
- Protect or cover exposed skin by putting hands and arms under or near the body and keeping your helmet on
- Keep your head down
- While in fighting hole, cover head with arms, place face against legs and place fingers in ears
- Stay down for 90 seconds after the shock wave has passed
- Don your field protective mask
- If warned of imminent attack, proceed to shelter or foxhole

7. **DECONTAMINATION PROCEDURES** - decontamination of radiological particles should be done away from the scene and further away from radioactive fallout exposure at a decontamination station. It should be continually done until the radioactivity has been reduced to a safe level.

- Early removal of radioactive "contamination" will reduce radiation burns, radiation dosage and the chances of inhaling or ingesting radioactive material.

Steps for self-decontamination include:

-Spot clean first using a cotton swab or gauze for moist areas and tape for dry areas to remove radioactive “hot spots” (concentration of Radioactivity)
-Carefully remove contaminated clothing and garments
-Deposit contaminated clothing and garments in a garbage bag or disposable container for disposal by burial at sea or in deep pits or trenches
-Carefully bathe or flush contaminated wounds with sterile water
-Apply impermeable dressing over any uncontaminated cut, scratch, or wound
-Shower thoroughly with soap and water. Scrub the entire body with a soft bristle brush giving special attention to hairy areas, nails, body orifices, and skin folds
-If areas become tender from excessive washing, gently rub skin with a small amount of lanolin or ordinary hand or face cream
-Repeat procedures again if any contamination remains

REFERENCES

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Medical Management of Radiological Casualties, Current Edition
Webster’s II New Riverside Dictionary, pg 135, 806
Marine Corps MCRP 4 – 11.1B
Field Manual 8-9 - NATO Handbook on the Medical Aspects of NBC Defensive Operations AMedP-6(B)

Radiological Review

1. What type of burst is most likely to be used against ground forces? What types of injuries would it likely cause?

2. Describe “flash blindness”.

3. Describe the signs and symptoms of mild, severe, and deadly levels of radiation exposure.

4. Describe the recommended antibiotic therapy to be administered following radiation exposure.