Medical Radiation Concerns for Funeral Directors

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We live in a world of radiation. In addition to man-made sources, we receive radiation from the atmosphere above us, the ground below us, the food we eat, and the air we breathe.

Radiation results from small bundles of very energetic waves coming from the nucleus of radioactive atoms. These atoms have unstable nuclei which produce specific emissions including alpha, beta, and gamma rays.

Radiation is able to change the DNA characteristics of the genetic material in both plants and animals. When living organisms are exposed to low doses of radiation, most cells tend to repair themselves rather quickly, so most of this radiation is relatively harmless.

However extended exposure or higher doses can permanently damage the cells. When damaged cells reproduce, they may produce abnormal cells such as cancer cells, thus the increased risk of cancer from radiation exposure. Prolonged exposure to higher doses can also damage the immune system exposing a person to an increased risk from other unrelated diseases.

Finally, radiation can outright kill living cells. While many of these cells can be replaced, major damage may have already been done to a particular organ or body system.

Radiation is measured in units called millirem (mrem), or thousandths of a rem (roentgen-equivalent-man). A rem is basically equivalent to a rad, another unit of measure.

The average person is exposed to 360 mrem (.360rem) per year. Under international standards, a person who works with radioactive material may be exposed to as much as 5000 mrem (5 rem) per year.

Depending on how much atmosphere you have above you determines how much radiation you receive from the cosmos. At sea level, you receive 26 mrem per year. At 3,000 feet your exposure is 41 mrem. In mile-high Denver, your exposure is 52 mrem.

If you live along the eastern seaboard or the gulf coast you receive about 16 mrem per year from the ground beneath you. If you live along the Rocky Mountains, you receive about 63 mrem and if you live elsewhere, the ground adds 30 mrem to your total exposure to radiation. The food you eat adds another 40 mrem or so to your total.

Even your lifestyle adds to the amount of radiation you are exposed to. When you travel by plane, you pick up another .5 mrem for each hour you are in the air. Watching TV
adds 1 mrem, working in front of a CRT computer monitor adds 1 mrem. Even the smoke detector in your house adds .008 mrem to your total radiation exposure.

If you have certain medical procedures done, the numbers climb quickly. A single dental X-ray adds 1 mrem, a chest X-ray 6 mrem, a CAT scan exposes you to 110 mrem, and an upper GI exam adds 245 mrem. If you wear a plutonium powered pacemaker it exposes you to 100 mrem.

While radiation exposure can cause serious damage and even death, we all know that radiation is an important part of medical diagnosis and treatment. Unfortunately, there is little difference between a radiation exposure level with no perceived effect and one with very harmful effects.

Medical uses of radiation fall into three categories:

1. X-ray—used for diagnosis
2. Nuclear Medicine—radioactive material used for diagnosis and treatment

From a funeral service standpoint, no special precautions are necessary when dealing with a person recently exposed to X-rays since the person does not become radioactive or retain any radioactivity from the procedure.

Special precautions are usually not necessary when dealing with a patient treated by the nuclear medicine department. Even if a patient dies while receiving a PET scan, the drug used deteriorates to the point it does not present a hazard within 1 hour and 45 minutes. By the time a removal would be made, the exposure to the embalmer would be minimal.

Strontium-89 however does present concerns. Any opening of the body or exposure to body fluids would expose the embalmer to Sr-89 in levels as high as 447 mrem per hour of exposure. However, most of these patients do not die during or immediately following treatment. Within 6 days the Sr-89 has been dispersed throughout the body and skeleton and contact with body fluids is no longer of concern.

The main concern then is with patients who are receiving certain types of radiation treatment for cancer.

Cancer cells are not able to repair themselves which is why damaging or killing these cells with high doses of radiation has become a successful form of cancer treatment.

There are two basic types of radiation treatment, external and internal. External treatment consists of bombarding the cancerous area with a concentrated beam of radiation. Logically, it is called external beam radiation treatment or EBRT. Like X-rays, this type of treatment creates no concern for the embalmer.

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1 NRC Information Notice 94-70
There are two types of internal treatment. The first is administered by capsule or IV and is best illustrated by the use of Iodine-131 to treat cancer of the thyroid and certain lymphomas.

This is an inpatient treatment. Generally, by the time a person is discharged following treatment, the radiation exposure to others is minimal and is rapidly decreasing as the days go by.

If a person dies during treatment or within a few days of discharge following treatment, the embalmer is advised to consult with the treating physician prior to prolonged exposure to the body or the commencement of embalming or other preparation of the remains.

The second type of internal treatment is called brachytherapy which is the implantation of radioactive material in or around the cancerous area. These procedures may utilize tubes, wires, or sealed capsule type implants.

One example is the use of Cesium-137 in the treatment of cancer of the cervix and endometrium. The implant is a metal capsule about the same diameter as a ballpoint pen filler and about an inch long. This again is an inpatient treatment where the capsule will remain in place for 1 to 7 days. The hospital room is equipped with special shields and contact with the patient is limited during treatment.
This type of treatment should create no concerns for the embalmer because the implant is removed prior to discharging the patient. If the patient dies in the hospital during treatment, the implant should be removed prior to removal of the remains.

Another use of brachytherapy is of more concern to funeral service. It is the treatment for prostate cancer using “seed” implants. This treatment protocol has been very successful when compared with EBRT and radical prostatectomy (surgical removal of the prostate). Funeral directors can expect to see more and more patients with these implants.
This treatment involves the use of Iodine-125 or Palladium-103 in small implants called “seeds.” They are about as long as a grain of rice but not much wider than an ink line on a piece of paper. They are inserted into the prostate using a needle under spinal or general anesthesia. Body imaging technology allows for precise placement in and around the prostate. Anywhere from 50 to 150 seeds may be implanted. Since the radiation only penetrates about 1 cm of tissue inside the body, the radiation can be placed where it will do the cancer the most damage with minimal harm to surrounding tissue.

Image of the pelvis
Prostate is in the center
The white dots are the radioactive implants or “seeds”

Abdominal X-ray showing radioactive seeds
The problem for the embalmer is that these implants are permanent. Rather than removing them, they are left inside the prostate as the radiation level gradually decreases.

The half-life of I-125 (the amount of time it takes for the radiation level to decrease by half) is 60 days. The amount of radiation continues to decrease by half again and again every 60 days. After 5 half-life “cycles” or 10 months these seeds will have lost 97% of their radioactivity. The half-life of P-103 is 17 days. Those seeds lose 97% of their radioactivity within 3 months after being implanted. They are considered “inert” once they have gone through 10 half-life “cycles” which would be 600 days (a year and nine months) for I-125 and 170 days or about 5 months for P-103 by which time they have lost 99.1% of their radioactivity.

Left undisturbed during these periods, they present little danger to others since the radiation is confined to the lower body. As long as the pelvis is not entered or the seeds have not been ruptured (such as being mechanically broken due to gunshot or other trauma) they are of little concern during this period of time and no concern afterwards.

The problem is in what the embalmer should do with a deceased who has received these implants or “seeds” within these time windows.

If the integrity of the seeds is compromised shortly after implantation, the embalmer could be exposed to significant levels of radiation during embalming or other preparation. Therefore, during preparation, the embalmer should avoid trocar use near the prostate where seeds could be dislodged, damaged, or aspirated.

If a body treated with I-125 or P-103 is cremated while the seeds are still radioactive, this could lead to dispersion of radioactive material within the retort. The cremated remains themselves may retain some radioactivity especially if seeds are recovered with the ashes.

The Nuclear Regulatory Commission has issued guidelines covering these circumstances, but no specific regulations currently exist. The safest course of action will depend on the type of radiation involved and the age of the implants. The most conservative option is to have the seeds removed or have the entire prostate removed intact by a pathologist and have it returned to the radiation oncology department where it can be isolated until the implants are no longer of concern.

In one case, a crematory was advised to proceed, but the hospital’s Radiation Safety Officer (RSO) surveyed the crematory afterwards and recovered as many of the seeds as possible for proper disposition. No contamination of the retort or the environment was detected. A small amount of radioactivity was emitted from the cremated remains, but the level became negligible once the ashes were placed in a metal urn.\(^2\)

This example seems to confirm the validly of the NRC guidelines\(^3\) which allow cremation but suggest limiting the number of bodies with these implants an individual

\(^2\) NRC- MR# 1-00-0010, July 24,2000
\(^3\) NCRP Report Number 37 and HPPOS-030 PDR-9111210152
It appears that limiting the number of cremations minimizes the chance of contaminating the retort. The exceptions are Ir-192 and Ta-182 (not used in prostate seeds) which cause significant radiological contamination to the crematory.

Every funeral director should already know about the hazards of cremating a body with a pacemaker. Funeral directors must now include nuclear medicine and radiation oncology as additional potential hazards that must be addressed.

Every funeral director should make it standard practice to inquire about any radiation therapy the deceased may have been receiving. Specific questions on radiation treatment should become part of the standard “checklist” when first contacting the family for permission to embalm or during the arrangement conference.

“Has your [father, mother, brother, sister, etc.] ever received any diagnostic procedures or cancer treatment involving radiation or implants?” is a good place to begin. Note the use of the key words “radiation” and “implants” to help the family recall what types of treatment the deceased may have received.

Remember that the death may occur months after cancer treatment. Prostate seeds are a very effective treatment, so the cause of death might be totally unrelated to cancer. The family can not be expected to understand the importance of this information and may not offer it without inquiry. If the answer is affirmative, more specific inquiry as to the date of treatment, type of treatment, and how it might affect the funeral home or crematory staff can then be made.

If the funeral director discovers that the deceased has been treated with implants and that they were implanted within the time frames noted above or if the funeral director has any other concerns, they should contact the treating physician, the Radiation Safety Officer at the treating hospital, or the Authorized Medical Physicist at the treating hospital. State governments also have radiation safety offices that can provide information and assistance.

**Sources**

American Brachytherapy Society
American Nuclear Society
Blasko, John, M.D., Northwest Tumor Institute, Seattle
Health Physics Society, University of Michigan
Henry Ford Hospital, Center for Oncology
National Institutes of Health
Nuclear Medicine Research Council
Switzer, David W., MS, DABR, Northern Rockies Oncology Center
U.S. Nuclear Regulatory Commission (NRC)
Yale University School of Medicine

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