Radiation safety culture management in veterinary medicine

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Summary statement

Medical imaging using ionizing radiation has grown tremendously in the last 50 years and has become a go-to diagnostic tool revolutionizing medical practice across the globe in both human and veterinary patient care.[1] There are three categories of radiation exposure: occupational, medical, and public. Diagnostic radiology, nuclear medicine, and radiation therapy are the most rapidly increasing sources of radiation exposure. Despite this, many workers in the human and veterinary health care fields have little or no training in radiation safety and protection.[2]

This paper outlines various aspects of a radiation safety culture (RSC) and how veterinary practices can manage these to better protect the health of staff, patients, and the public.

Introduction

Veterinarians, veterinary technicians, and staff encounter potentially carcinogenic items in the course of performing clinical care,[3] including radiation from scatter that occurs during imaging procedures using x-rays.[4]

Radiation safety programs can provide structure to the process of taking x-rays. These programs are designed to optimize radiation dose and workflows to maximize staff and patient safety.

To support an accurate medical diagnosis, the primary challenge for these programs is to achieve the optimized dose, which is acquired by minimizing the radiation dose from any single exposure while obtaining optimal diagnostic image quality. The optimized dose is best accomplished when an effective RSC is in place.

Radiation safety culture (RSC) is a combination of knowledge, beliefs, and practices related to radiation safety. A strong RSC reduces radiation exposure, provides more effective diagnosis and treatment, and improves staff and patient safety. RSC in veterinary medical facilities can be achieved through justification, protection optimization, and dose optimization, and it will deliver the workflow efficiency we all desire.

Establishing a radiation safety culture

The development of an RSC is more essential than the rules themselves. Culture is a way of life, an integrated pattern of behavior. Culture is what a person does when no one is watching. All front-line staff in veterinary healthcare (e.g., doctors, veterinary technicians, veterinary assistants, practice managers) should build a sense of RSC in their working routines. Being aware of occupational exposures as well as patient dose and reducing radiation dose to As Low As Reasonably Achievable (ALARA)[5] should become second nature, and therefore part of the RSC.

Veterinary hospital management commitment and support is essential for driving the development of an RSC. Management should communicate that radiation safety is an essential part of high patient-care standards as well as quality and risk management. An effective RSC includes needed resources, particularly for training, to grow the culture of radiation safety and to demonstrate the importance of its impacts on quality patient care and staff safety.

The veterinary healthcare sector delivers a large and increasing collective radiation dose to patients each year, primarily for diagnostic purposes. Although veterinary patient dose is not the focus of current regulations, it is recognized that collective veterinary patient dose is inevitably linked to cumulative occupational and public exposure.[2] In other words, by reducing veterinary patient dose, we will reduce occupational and public exposure.

Per current regulations, every facility that uses radiation must have radiation safety guidelines in place. The establishment of an RSC lies in education, awareness of radiation safety practices, and promoting collective stewardship of the RSC. The human medical community has been pushing for programs to establish a strong RSC.[6]

A robust RSC is the pathway towards healthier and safer veterinary facilities. A positive RSC also leads to radiation dose reduction, more effective diagnosis and treatment, and improved staff and patient safety through the use of **technology and workflows, care planning, and dose optimization**.

Technology and workflows

Digital radiographic equipment and technology in coordination with workflows optimized for the advent of digital imaging offer a new paradigm for practices to realize their RSC goals. Ideally, digital radiographic equipment will be selected for the patient care requirements of the practice and will be installed by an experienced professional skilled in digital imaging integration to optimize results:

- Digital radiographic panels should have a high detective quantum efficiency (DQE) and durability demonstrating longevity.[7]
- Panels and image processing should allow persistent optimized dose with image contrast, brightness, and resolution that results in a high-quality diagnostic image.[8]
- The digital imaging parameters must be optimized for the best performance of a particular system to facilitate an optimized dose.[7]
- Techniques to optimize the features of a digital imaging system are essential to dose containment.[1]

The day-to-day methods of veterinary facilities must promote the lowest radiation dose without encouraging aberration such as dose creep[9] or other unnoticed variations in diagnostic radiation exposures.[10] Workflows should also include considerations for animal positioning, use of personal protective equipment (PPE), and use of image processing software[11] to enhance diagnostic image quality without the need to increase radiation dose.

Care planning

RSC procedures should include justification for the procedure and planning of the radiation necessary. Imaging procedures should do more good than harm to the individual patient, and diagnostic imaging plans should be made accordingly. Aspects to consider include modality and scope of anatomical study:

- What is the optimal modality that will render the image while minimizing radiation exposure? For example, can the diagnosis be obtained by an ultrasound procedure rather than a projection radiograph or a projection radiograph instead of a CT scan?
- Is a whole-body study required when a focused thoracic scan is appropriate for the clinical disease presentation?

Dose optimization

Medical imaging examinations should use techniques that are repeatable and adjusted to administer the lowest radiation dose that yields an image quality optimized for an accurate diagnosis.

The technique factors used should be chosen based on the clinical indication, patient size, and anatomical area scanned. Equipment should be adequately maintained and tested to ensure optimal dose and image quality.[4]

The reduction of patient dose using the ALARA[5] principle is a multifactorial solution that allows lowest dose exposure while gaining a high-quality diagnostic image. The principles of time, distance, and shielding are primary considerations. Additional considerations are the use of a radiographic detector with a high DQE and optimized imaging parameters such as the following:

- Generator settings
- Image processing software[11]
- Training
- Use of a customized technique chart specific to practice workflows, patient size, anatomy, generator settings, table, and detector panel.

Summary

A radiation safety culture can be achieved by veterinary hospitals through a balanced approach that includes people, process, technology, and dose optimization. Effective RSC programs are not tied to any one product or approach. Given that radiation safety is a reported top concern of veterinary technicians,[12,13] establishing these programs is important as they will not only increase staff safety but also likely increase staff satisfaction, retention, and efficiency. IDEXX is dedicated to the advancement of the quality of veterinary medical care.

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