POSITION STATEMENT

Radiation Safety in the Endoscopy Setting

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Definition of Terms
ALARA is an acronym that stands for “As Low As Reasonably Achievable,” which refers to the principle/goal of keeping radiation exposure to a minimum (National Council on Radiation Protection and Measurements, NCRPM, 2000a, Campbell et al., 2002).

Nursing Assistive Personnel refers to individuals who are trained to function in an assistive role in the gastroenterology setting. Nursing Assistive Personnel who have specialized training or education in a specific area (gastroenterology), may be further classified as Technicians, for example, GI assistants, GI technicians, GTS (GI Technical Specialist) or AGTS (Advanced GI Technical Specialist) who have direct patient care responsibility and are supervised by a GI Registered Nurse (RN) (ANA, 2010).

Brachytherapy refers to a type of radiation therapy in which radioactive material sealed in needles, seeds, wires, or catheters is placed directly into or near a tumor. Also called implant radiation therapy, internal radiation therapy, and radiation brachytherapy (National Cancer Institute (NCI), 2013).

Collimating refers to the act of decreasing the size of x-ray beam, which minimizes the volume of tissue irradiated in the patient and reduces scattered radiation (National Council on Radiation Protection Measurements, NCRPM, 2000b).

Deep Dose refers to the penetrating dose equivalent from all types of radiation at a depth of 1000mg/cm squared in soft tissue—the absorbed dose equivalent to the whole body (United States Nuclear Regulatory Commission (USNRC), 2012).

Dose Limits Annual radiation dose limits are as follows (USNRC, 2012; Jankowski, 1992; NCRPM, 2000b):

<table>
<thead>
<tr>
<th>Dose Limits</th>
<th>Limitation</th>
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<tbody>
<tr>
<td>Whole Body, Deep Dose</td>
<td>5 rem, 5,000 mrem or 50 mSv</td>
</tr>
<tr>
<td>Shallow Dose</td>
<td>50 rem, 50,000 mrem or 500mSv</td>
</tr>
<tr>
<td>Eye Dose</td>
<td>1.5 rem, 1,500 mrem or 15 mSv</td>
</tr>
<tr>
<td>Pregnancy Dose</td>
<td>0.5 rem, 500 mrem or 5 mSv throughout gestation or 0.05 rem, 50 mrem or 0.5 mSv per month once the pregnancy is declared</td>
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</table>

Eye Dose refers to the dose equivalent to the lens of the eye from all radiation sources. Dose to
the lens of the eye is based on the film badge worn closest to the head area (on thyroid shield).

**Film Badge** is an assembly containing a packet of unexposed photographic film and filters. When the film is developed, the dose and type of radiation exposure can be estimated (Phillips, 2007).

**Film Dosimeter** is a radiation dose-measuring device.

**Millirem (mrem)** refers to a unit of radiation equivalent to 1/1,000 of a rem or 0.01 mSv for the System International units (USNRC, 2012).

**Gastroenterology Nurse** refers to practitioners (APRN, RN, LPN/LVN) in gastroenterology, hepatology, or endoscopy.

**Ionizing Radiation**, commonly referred to as radiation, is a type of radiation made (or given off) by x-ray procedures, or radioactive substances. At high doses, ionizing radiation increases chemical activity inside cells and can lead to health risks, including cancer (NCI, 2013).

**Radiation Safety Officer** is an individual with extensive training and education in areas such as radiation protection, radiation physics, radiation biology, instrumentation, dosimetry, and shielding design (NCRPM, 2000b).

**Radiology** refers to the branch of medicine which uses X-rays, radioactive substances, and ionizing radiation for diagnosis and treatment.

**REM** refers to the traditional unit of absorbed dose equivalent to humans (NCRPM, 2000b), now expressed as Sievert (SV) for the system international units.

1 SV=100 rem or 1 rem= 10 mSv (USNRC, 2012)

**Shallow Dose** refers to the external exposure dose equivalent to the skin or an extremity at a tissue depth of 0.007 centimeters (7 mg/cm²) averaged over an area of 1 square centimeter (USNRC, 2012).

**Background**

Radiation safety in gastroenterology pertains to minimizing the exposure of ionizing radiation from the use of fluoroscopy and/or x-rays. Radiographic equipment is often utilized during endoscopic procedures. These procedures are performed in a variety of inpatient and outpatient settings with or without the presence of a radiologist or radiology technician.

Radiation exposure is cumulative over time. It can cause an acute direct injury to skin and other body tissues and may cause cell mutations leading to cancer or DNA damage. The length and intensity of exposure are affected by the type of radiographic equipment, the type of procedure, exposure parameters, and the size of patients. Larger patients require a more intense beam of radiation which increases the scatter of radiation to others in the vicinity (Chaffins, 2008; Johlin, Pelshing, & Greenleaf, 2002).

The amount of radiation exposure to patients and staff should be minimized because of its
potential damaging effects. Special consideration should be made during declared pregnancies to monitor and minimize the exposure of the fetus as well as the mother (Cousins, 2008; ESGE, 2012). Children also need special consideration since they are more sensitive to radiation exposure and its risks (ESGE, 2012). Radiation safety in the practice setting is a responsibility shared by the department of radiology, the department of radiation safety/health physics, and endoscopy personnel.

**Position**
SGNA supports the position that the gastroenterology nurse and/or nursing assistive personnel responsible for the setup and operation of all radiographic equipment must be educated in the technical aspects of radiology as well as equipment maintenance and safety controls. The person responsible for the intra-procedural operation of the radiographic equipment must not be the registered nurse responsible for monitoring the patient receiving sedation and analgesia.

The practice of radiation safety is defined and regulated by federal, state, and local agencies. Radiation policies and procedures should be written, reviewed according to institutional policies, and accessible to all endoscopy personnel.

The gastroenterology nurse and/or nursing assistive personnel present during the exposure must be provided with appropriate protective and monitoring devices (i.e. thyroid shields, gloves, aprons, eye shields, and monitoring badges). The pregnant nurse or nursing assistive personnel must follow institutional policy. The patient should be protected by minimizing the length of radiation exposure and shielding highly radiosensitive body areas. Designated areas where radiographic equipment is in use should be clearly identified.

In addition to following these guidelines, SGNA also recommends that each practice setting maintain and implement a quality monitoring plan.

**General Principles**

**Radiation source in the endoscopy setting**
Radiation exposure refers to “the amount of electrical charge produced by a mass of matter when xrays are delivered to a specific point” (Campbell 2002). There are three types of radiation exposure within the room: primary, secondary, and leakage.

1. **Primary** - The incident beam is the primary radiation source of radiation exposure for the patient. The primary radiation beam produced is focused and directed through the area to be examined (Shymko & Shymko, 1998).

2. **Secondary** - The personnel in the room are exposed to secondary radiation or scatter radiation (Campbell et al., 2002; Johlin et al., 2002). This is the major source of radiation to the endoscopist and staff.

3. **Leakage** - Radiation from the radiographic machine itself (Campbell et al., 2002).
Secondary, Primary and Leakage Exposure To The Endoscopist (E), and Assistants (A1, A2).

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I. Minimizing Radiation Exposure

Exposure to radiation should be as low as reasonably achievable (ALARA). Endoscopy personnel can limit exposure to radiation by using the principles based on distance, time, and shielding. Communication with radiology team is essential to follow these principles.

A. Distance self as much as possible from radiation source (Fink, 2009; Campbell et al., 2002; NCRPM, 2000a & b; Shymko & Shymko, 1998; Johlin et al., 2002)

B. Minimize the amount of time radiation is used for imaging.
   1. Keep the fluoroscopy unit off when not in use (Campbell et al., 2002; Johlin et al., 2002).
   2. Rotate staff assigned to procedures requiring fluoroscopy (Johlin et al., 2002; Janowski, 1992).
   3. Use a pulse mode rather than continuous imaging to reduce radiation exposure (ASGE, 2010; Fink, 2009; Uradomo, Goldberg, & Darwin, 2006).
   4. Use a programmable audible alarm system preset to sound at fixed intervals to alert the team about fluoroscopic time elapsed (ASGE, 2010; Campbell et al., 2002).
   5. Limit the amount of boost fluoroscopy (i.e., high dose for heavier, dense bodies) being used by personnel (ASGE, 2010; Johlin et al., 2002).
   6. Select contrast medium that is effective for the type of study being done (SGNA, 2008).

C. Minimize the amount of exposure risk
   1. Face the unit that is emitting radiation (if using a single sided apron)
   2. Use protective shielding devices such as the following (ASGE, 2010; Fink, 2009; Campbell et al., 2002)
      - Lead aprons should
         o Fit proportionally to the body
         o Provide back protection (wrap-around apron) when duties require staff members to turn away from the radiation source
      - Maternity aprons should be provided to pregnant individuals
      - Thyroid shield
      - Lead glasses
         o Consider side view eye protection
      - Radioprotective gloves
      - Mobile or fixed radiation shields
      - Store leaded protective devices vertically
      - Annually test leaded protective devices radiographically.
      - Clean aprons and shields according to manufacturer’s recommendations.
   4. Use a protective or sliding leaded panel placed on three sides of the x-ray carriage to reduce radiation scatter to the personnel standing to the side, head, or foot of the fluoroscopy table (Fink, 2009; Johlin et al., 2002).
   5. Maintain communication with the radiological team
   6. Position image intensifier as close as possible to patient in order to decrease scatter, reduce magnification, reduce patient dose, and improve image quality (Chaffins, 2008).
   7. Limit the size of the fluoroscopic field by collimating the x-ray beam to the
anatomic region of interest (ASGE, 2010; Campbell et al., 2002; NCRPM, 2000b)
8. Adjust the collimation to smaller size for children (ESGE, 2012)
9. Protect the most radiosensitive organs in children (ESGE, 2012).
10. Use patient gonadal shielding as appropriate (SGNA, 2008).
11. Store the “last image hold” as an alternative to taking multiple radiograph images (ESGE, 2012; ASGE, 2010).
12. Use standardized “X-ray On” radiation warning signs placed outside of the fluoroscopy room to warn personnel of the potential for radiation exposure (ASGE, 2010; Shymko & Shymko, 1998).
13. Post warning signs to alert staff where radiation hazards may be present or in use (OSHA, 1996; Jankowski, 2002).

II. Monitoring Radiation Exposure
A. A monitoring device should be worn by personnel during endoscopy cases requiring fluoroscopy. Radiation dose is best estimated by wearing two dosimeters: one at the neck, outside the apron, and the other one under the apron (Campbell et al., 2002; Chida, 2013; Cousins, 2004; ESGE, 2012). However, the device should be worn according to institutional policies (NCRPM, 2000b; Phillips, 2007; Campbell et al., 2002; Shymko & Shymko, 1998).
B. The monitoring device should be removed and stored in a radioactive protective container or in the endoscopy area in a place that reduces exposure to matter (e.g. heat) that may alter the readings (Shymko & Shymko, 1998).
C. The monitoring device data are collected and then communicated and documented per institutional policy.
D. The radiation time used for each endoscopy procedure can be obtained from the radiology technologist and documented according to the institution’s policy and procedure (Orders & Wright, 2003).

III. Policies and Procedures
A. Policies and procedures should be developed collaboratively and approved by the radiation safety officer and/or institution’s radiation safety committee.
B. Policies and procedures should include the following:
   1. Identification of measures for protecting patients and personnel from unnecessary exposure to radiation, including potential health risks.
   2. Documentation of pregnancy status prior to procedure
   3. Identification of the person(s) responsible and accountable for radiation safety.
   4. A statement indicating the need for protection for pregnant personnel.
   5. A schedule for cleaning and radiographic testing of lead protective devices (ASGE, 2010; Shymko & Shymko, 1998).
   6. The orientation and ongoing education of personnel in the endoscopy setting (Jankowski, 2002; NCRPM, 2000a).

IV. Quality Improvement (QI)
The institutional designee e.g. radiation safety officer, health physicist should act as an advisor in the design and implementation of a QI program as it applies to equipment and radiation safety.
Summary
It is imperative that the nurse and/or nursing assistive personnel responsible for the setup and operation of all radiographic equipment be educated in the technical aspects of radiology as well as equipment maintenance and safety controls. Institutional policies regarding radiation use and safety must be followed.

References

**Recommended Reading**


**Acknowledgments**

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