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Awareness of Radiation Protection Among Undergraduate Radiography Students in India.

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ABSTRACT

Radiation protection is a critical component of radiographic practice, aiming to minimize exposure risks for patients, healthcare workers, and the general public. Awareness and adherence to radiation protection principles are particularly vital for undergraduate radiography students, as they form the foundation of future radiologic technologists. This review explores the level of awareness regarding radiation protection among undergraduate radiography students in India, identifying gaps in knowledge, factors influencing awareness, and strategies for improvement.

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INTRODUCTION

Radiation protection encompasses practices designed to safeguard individuals from the harmful effects of ionizing radiation. These principles are governed by international guidelines, including those established by the International Commission on Radiological Protection (ICRP). In India, radiography students play a pivotal role in implementing these principles as they transition into professional roles. However, the extent of their awareness and preparedness remains underexplored.

This review aims to evaluate the awareness of radiation protection among undergraduate radiography students in India, emphasizing the importance of education and training in fostering a safety-conscious culture in radiology.

Importance of Radiation Protection

Ionizing radiation has well-documented risks, including:

- Somatic effects, such as tissue damage and radiation burns.
- Stochastic effects, including an increased risk of cancer.
- Genetic effects that may impact future generations.

Radiation protection is based on three fundamental principles:

1. Justification:

The primary principle of justification in radiographic procedures is to ensure that the benefits outweigh the risks. Decisions that modify radiation exposure must result in a net positive outcome, balancing advantages against potential harm. For example, deciding between using X-rays or ultrasound involves evaluating their relative benefits and drawbacks. Typically, the justification process relies on professional experience, judgment, and practicality, while also considering regional or national resources. For instance, fluoroscopy might be chosen over traditional radiography for chest imaging due to cost efficiency.

Special consideration is needed for diagnostic procedures where the primary aim isn't patient benefit, such as radiography conducted for insurance purposes. Justification is categorized into three levels:

Level 1: Acceptance of medical radiation use as providing more benefit than harm.

Level 2: Justification of specific procedures for specific goals (e.g., chest X-rays for symptomatic patients).

Level 3: Tailoring procedures to individual patient needs.

2. Optimization:

The principle of optimization involves minimizing radiation exposure to levels as low as reasonably achievable (ALARA), considering economic and social factors. This principle ensures that the required diagnostic quality is maintained while reducing unnecessary exposure. There is significant potential for dose reduction in diagnostic radiology through practical, low-cost strategies without compromising diagnostic accuracy (ICRP 60).

Optimization occurs at two main levels:

The design and construction of equipment and facilities.

Routine radiological practices.

Some interventions, such as using anti-scatter grids, improve image contrast and resolution but can increase patient dose by 2–4 times. Other factors, like choosing the appropriate screen/film combination or adjusting tube potential to balance image contrast and patient dose, are crucial. For pediatric radiography, low-energy X-ray beams require specific grid adjustments to manage dose effectively. Additionally, measures such as copper filtration can help reduce low-energy X-rays.Regular monitoring of patient doses and comparisons with diagnostic reference levels help identify instances where doses are unusually high, enabling corrective action to align with best practices.

3. Dose Limitation:

Dose limitation refers to adhering to established thresholds for radiation exposure to protect both occupational workers and the public. The total dose received by any individual must not exceed prescribed limits.

The effective dose limit is 1 mSv per year under normal circumstances.

In exceptional cases, a single-year effective dose can be 5 mSv, provided the five-year average remains below 1 mSv per year.

Specific limits include:

Lens of the eye: 1.5 mSv per year.

Skin: 50 mSv per year.

Understanding and applying these dose limits are essential for radiography students to ensure safety for both patients and themselves.

Awareness Among Undergraduate Radiography Students

Current Status in India

Studies suggest varying levels of awareness among radiography students regarding radiation protection practices. Commonly identified gaps include:

- Limited knowledge of radiation dose levels for common procedures.
- Insufficient understanding of ALARA principles.
- Lack of familiarity with protective measures, such as shielding and proper equipment usage.

Factors Influencing Awareness

1. Curriculum: The inclusion and emphasis on radiation protection in academic programs.
2. Clinical Training: Practical exposure to radiation safety measures during internships.
3. Faculty Expertise: Availability of knowledgeable instructors to teach and reinforce radiation protection principles.
4. Access to Resources: Availability of guidelines, protective equipment, and updated information.

Challenges in Enhancing Awareness

- Inconsistent Training: Variability in curriculum design across institutions.
- Resource Constraints: Limited access to modern equipment and protective gear.

• Overcrowded Clinical Settings: High patient loads that may compromise adherence to safety protocols.

Strategies for Improvement

1. Curriculum Reforms:
■ Integration of comprehensive radiation protection modules.
■ Regular updates to align with international standards.
2. Workshops and Seminars:
■ Organizing awareness programs on radiation safety.
■ Encouraging participation in national and international conferences.
3. Simulation-Based Training:
■ Utilizing virtual and physical simulation tools to teach radiation safety.
4. Assessment and Feedback:
■ Conducting regular assessments to evaluate student knowledge.
■ Providing constructive feedback to address gaps.

Conclusion

Awareness of radiation protection is essential for undergraduate radiography students to ensure safe and effective practice. While there are significant gaps in knowledge among students in India, targeted educational interventions and resource allocation can bridge these gaps. Enhancing awareness will not only improve patient safety but also foster a culture of responsibility and professionalism among future radiographers.

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