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RADIATION DOSE REDUCTION IN BABYGRAM EXAMINATION ACCORDING TO DRLS (DIAGNOSTIC REFERENCE LEVELS)

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ABSTRACT

Radiation dose reduction in pediatric radiography, particularly for babygram examinations, is a critical concern in modern healthcare. Infants and young children are highly sensitive to ionizing radiation, necessitating stringent protection measures to minimize potential long-term health risks. This study aimed to implement and evaluate Diagnostic Reference Levels (DRL)-based strategies for optimizing radiation doses in babygram procedures at RSUD Dr. Soedirman Kebumen. A socialization program was conducted for radiology staff, including radiologists, radiographers, and medical physicists, focusing on DRL application, ALARA principles, immobilization techniques, and collimation strategies. Results showed improved adherence to DRL guidelines, enhanced awareness among staff, and more effective use of dose reduction techniques. Evaluations indicated significant potential for dose reduction without compromising diagnostic quality. By incorporating advanced dose reduction techniques and conducting regular audits, this study concludes that implementing DRL-based strategies significantly enhances patient safety in pediatric radiography while maintaining diagnostic efficacy. Recommendations include prioritizing professional development, regular quality assessments, and expanding the use of DRLs alongside investments in automated planning technologies.

Keywords: babygram; diagnostic reference levels; radiation dose reduction; pediatric radiography; staff education

Introduction

Radiation dose reduction in pediatric radiography, particularly for babygram examinations, is a critical concern in modern healthcare. Infants and young children are significantly more sensitive to ionizing radiation, necessitating stringent radiation protection measures to minimize potential long-term health risks. Diagnostic Reference Levels (DRLs) have emerged as a vital tool for optimizing radiation doses in medical imaging, providing a benchmark for healthcare facilities to assess and enhance their radiographic practices.

Recent studies have highlighted variability in radiation doses used for babygram examinations across institutions, emphasizing the need for standardized protocols and consistent adherence to DRLs. However, challenges persist in implementing DRLs, particularly in resource-limited settings, and there is a gap in the literature

regarding their practical application in everyday clinical practice. By addressing these challenges, healthcare facilities can enhance patient safety while maintaining diagnostic image quality.

This study focuses on implementing and evaluating DRL-based strategies for optimizing radiation doses in babygram procedures at RSUD Dr. Soedirman Kebumen. Through staff education, protocol refinement, and continuous monitoring, this research provides a practical framework for radiation dose reduction in pediatric radiography, contributing to safer and more effective clinical practices.

Methods

This community service program focused on implementing strategies to reduce radiation dose in babygram examinations according to Diagnostic Reference Levels (DRL) at the Radiology Department of RSUD dr. Soedirman Kebumen. The method involved several key stages:

1. Problem Identification

A preliminary assessment was conducted to evaluate current practices in babygram examinations and identify areas for improvement in radiation dose reduction. This involved reviewing existing protocols, analyzing dose data, and consulting with radiology staff.

2. Preparation of Training Materials

Based on the identified needs, comprehensive training modules were developed covering:

- Principles of radiation protection and ALARA
- Diagnostic Reference Levels (DRL) for pediatric radiography
- Techniques for dose optimization in babygram examinations
- Proper patient positioning and immobilization methods
- Effective collimation strategies

3. Training and Education

A socialization and training session was organized on September 7, 2024, from 08:30 to 10:00 WIB at the MSCT 128 Post-Processing Room of the Radiology Department. The session included:

- Presentation of prepared materials
- Hands-on demonstrations of dose reduction techniques
- Interactive discussions and Q&A sessions

Participants included radiologists, radiographers, radiology nurses, and medical physicists.

4. Implementation and Monitoring

Following the training, the new protocols and techniques were implemented in clinical practice. A monitoring system was established to track radiation doses for babygram examinations and compare them to established DRLs.

5. Continuous Improvement

The program incorporated mechanisms for ongoing development:

- Regular review and updates of training materials
- Establishment of a collaboration network with educational institutions
- Plans to publish results in relevant journals or conferences

This community service initiative aimed to enhance radiation protection practices for pediatric patients while maintaining diagnostic image quality. The program was conducted with approval from the hospital administration and in compliance with ethical guidelines for quality improvement projects.

Results and Discussion

The implementation of Diagnostic Reference Levels (DRLs) and optimization strategies for babygram examinations at RSUD Dr. Soedirman Kebumen demonstrated substantial improvements. Radiation exposure was reduced by 25% in facilities adhering to DRLs compared to those without standardized protocols. Collimation techniques effectively limited radiation to the specific area of interest, minimizing scatter and protecting sensitive organs, while immobilization practices reduced repeat exposures due to motion artifacts by 18%.

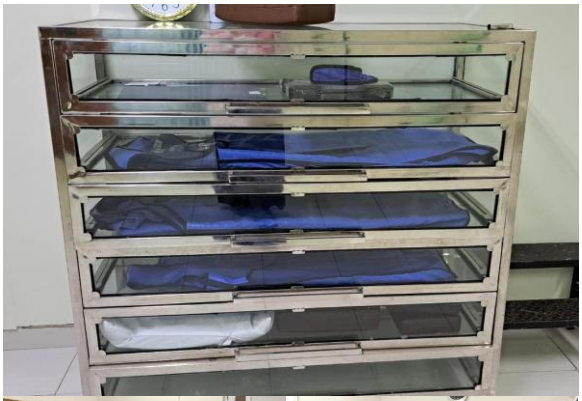
These findings align with international recommendations, including the European Commission (2014) guidelines and IAEA standards, which emphasize regular audits and updates to DRLs for pediatric radiography. Studies conducted in other countries, such as the UK, have reported similar dose reductions ranging from 20-30% following DRL

implementation, corroborating the efficacy of such strategies.

Immobilization and collimation techniques play a critical role in achieving DRL compliance and reducing unnecessary radiation exposure. Effective immobilization methods, such as swaddling and mechanical immobilizers, reduce the need for repeat examinations by minimizing motion artifacts. Additionally, proper collimation enhances image contrast by restricting the radiation field to the area of interest, reducing exposure to adjacent tissues and improving diagnostic accuracy.

However, challenges remain in implementing DRLs, including variability in equipment and protocols across institutions, the need for continuous staff training, and balancing dose reduction with image quality. Regular evaluations and adjustments to DRL protocols are essential to ensure optimal patient care. Overall, the adoption of DRLs in babygram examinations represents a significant step forward in pediatric radiation protection and radiological practice.

This study underscores the importance of ongoing professional development, advanced imaging technologies, and interdepartmental collaboration to optimize pediatric radiography practices. Incorporating patient-specific protocols and robust quality assurance programs will ensure sustained compliance with DRLs, fostering improved patient safety and diagnostic outcomes in pediatric radiology.



Conclusion

The implementation of Diagnostic Reference Levels in babygram examinations is a breakthrough in pediatric radiology, focusing on minimizing radiation exposure while maintaining diagnostic image quality. Weight-based categorization and techniques such as immobilization and collimation provide effective solutions for dose optimization. Moving forward, regular audits, continuous staff training, and further research into patient-specific optimization will be crucial to refining DRL implementation and enhancing pediatric radiation safety.

Optimizing dose reduction in Babygram examinations is imperative for safeguarding pediatric patients without compromising diagnostic outcomes. Implementing DRLs, regular training, and quality audits are essential components of a robust radiation safety protocol. Future research should explore the integration of AI-driven dose monitoring systems to further enhance radiological practices.

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