

## CHALLENGES FACED IN PEDIATRIC RADIOGRAPHY AND SOLUTIONS FOR POSITIONING

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### ABSTRACT

This article examines the multifaceted challenges encountered in the domain of pediatric radiology positioning and presents a comprehensive overview of effective solutions to address these obstacles. Pediatric radiology, while essential for accurate diagnoses, often presents unique challenges stemming from children's inherent tendencies to be uncooperative or anxious during medical procedures. Through an extensive exploration of the literature and practical insights, this study sheds light on the complexities of patient cooperation, image quality concerns, and the overarching need for patient-centred care. The article delves into solutions such as customized positioning aids, distraction techniques, and tailored communication that have proven successful in creating a more comfortable and cooperative environment for pediatric patients. Additionally, the role of collaborative efforts with play specialists and parental involvement in mitigating these challenges is underscored. The synthesis of these strategies not only addresses technical challenges but also emphasizes the importance of emotional well-being for young patients undergoing radiological procedures. In a rapidly advancing field, this article provides valuable insights for medical practitioners, encouraging a holistic approach that combines technical innovation with empathetic patient care to overcome the unique challenges faced in paediatric radiology positioning.

### I. INTRODUCTION

Radiological examinations have become essential within the healthcare system, aiding in the assessment and diagnosis of various abnormalities. This encompasses the use of different modalities some of which might entail encountering potentially harmful ionizing radiation<sup>[1]</sup>. Paediatric radiography constitutes a specialized field within radiology focused on capturing images to support the healthcare and medical needs of individuals ranging from new-borns up to 14 years of age<sup>[2]</sup>. Radiological imaging is an invaluable diagnostic tool for young individuals, offering substantial benefits compared to its use in adults. However, it also introduces a set of distinctive challenges that need to be addressed. Children are very sensitive to radiation and are hard to handle, specialized training and certification are essential for paediatric imaging, ensuring the proficient use of comprehensive expertise, meticulous knowledge, and a range of dedicated or versatile equipment<sup>[1,3]</sup>. Technologists must establish rapport, gain trust, and secure cooperation from the child throughout the examination. This process begins with the initial interaction between the patient and the technician, setting the tone for a lasting and productive relationship. Acknowledging that children are becoming more irritable and exceptionally perceptive of unfamiliar individuals and surroundings is crucial. This poses a significant obstacle for radiographers and clinical staff, who must establish rapport and secure the child's trust and cooperation prior to and throughout the examination, which becomes even more challenging when dealing with children who are unwell and in pain<sup>[2,3]</sup>. In the realm of paediatric radiography, professionals utilize specialized approaches, equipment, and methods of engaging with patients to achieve precise imaging outcomes. Their aim is to both reduce radiation exposure and prioritize the well-being and ease of young patients throughout the imaging process. Numerous endeavours are required to ensure the provision of efficient and high-quality imaging services tailored to children. Specialized imaging protocols are necessary to capture the images, and for longer procedures like MRI, sedation or general anaesthesia might be needed. Healthcare staff must undergo specific training, and careful expertise is essential for image evaluation. Additionally, when utilizing ionizing radiation, it's crucial to account for potential radiation exposure<sup>[2]</sup>. In paediatric radiography, it's crucial to obtain images with excellent contrast and resolution to reduce the necessity for repeat scans and minimize radiation-related hazards. When using ionizing radiation in medical contexts, strict adherence to radiation

principles – encompassing Justification, Optimization, and Dose Limits – becomes a vital necessity. Various distinct challenges encountered while delivering these services have been subsequently addressed<sup>[2,3]</sup>.

## II. CHALLENGES IN PAEDIATRIC RADIOGRAPHY AND THEIR SOLUTIONS

### Environment

Establishing a foundation for obtaining high-quality images in children hinges on building their trust and cooperation, both prior to and during the examination. Given children's inherent wariness of unfamiliar settings and strangers, it's crucial to foster a positive patient experience. Enhancements to the radiology department's external environment can contribute to this goal, such as adorning the walls with vibrant characters and incorporating child-centric elements like books and even a small aquarium within the waiting area<sup>[4]</sup>. Experts often recommend using things that can help take a child's mind off their worries and fears. In the x-ray room, projectors can be used to show interesting things and distract the child. But we have to be careful when using things that need electricity. We need to make sure they are put in a safe and good place where they won't be a danger, and we should avoid having wires from the devices spread across the room.

**Successful radiographic studies are dependent on two things:**

- The attitude and approach of radio technologists to a child.
- The radiographer must have good knowledge of radiologic equipment and its use.

**While coming for an examination most children are accompanied by parents. It is important to follow the protocol:**

- Proper introduction of yourself as the technologist.
- Proper instructions should be followed given by the paediatrician or physician.
- Explain the proper procedure and what your needs will be during an examination.

When kids are in a new place like the radiology department, they might feel upset or scared. It's normal for them to cry, be afraid, or not want to cooperate. The person operating the machines needs to be good at talking to both the child and the parent. They should explain things clearly using words that everyone understands. They'll say what they're going to do during the test. Before going into the room where the x-ray is taken, the technologist should make the waiting area friendly and comfortable. They can talk to the parent or caregiver to help with this. Sometimes, if the child is really not cooperating, they might need to use immobilization devices to keep the child still during the test<sup>[1,2]</sup>.

### Radiation protection

Children are more sensitive to radiation, making it essential to minimize their exposure. Traditional imaging techniques may deliver higher doses than necessary, increasing the risk of potential long-term effects. Ensuring radiation protection and safety holds significant importance for this demographic. Children face a cancer induction risk that is approximately 10 times greater than that of adults<sup>[5,7]</sup>. Furthermore, considering children's extended life expectancy, there is a heightened potential for the emergence of potential radiation-related hazards. After reviewing existing literature<sup>[6,8]</sup>, it is recommended that the utilization of CT scans be carefully managed and limited to necessary cases, adhering closely to the principle of keeping radiation exposure As Low As Reasonably Achievable (ALARA). Selecting the appropriate imaging modality should be based on the specific clinical requirement; for instance, ultrasound (USG) could be favoured over CT for suspected appendicitis cases. In most instances of cross-sectional imaging for children, MRI is the preferred choice, except when evaluating trauma. Implementing advanced imaging technologies like ultrasound, MRI, and low dose CT scans can provide detailed images with reduced radiation exposure.

### Training

It's imperative to guarantee that only adequately trained staff are assigned, and their competencies are consistently assessed. Unfortunately, there's limited motivation for radiographers to specialize in this field, leading to a scarcity of dedicated professionals for paediatric radiography. Similarly, radiologists interpreting paediatric cases must possess profound expertise and comprehensive understanding. Identical imaging observations in both adult and paediatric cases might not necessarily indicate the same ailment in children, as paediatric pathologies differ significantly from those in adults<sup>[1]</sup>.

### Specialized Equipment

Paediatric-appropriate equipment and facilities necessitate specialized features, which can vary from premature infants to teenagers of adult size. The equipment is designed for user-friendliness, enabling swift acquisition of diagnostic images. When needed, image viewing and workflow stations facilitate rapid image transfer to the Picture Archiving and Communication System (PACS), simplifying reporting and audits by radiologists. However, not all technologists are comfortable working with children, as some may become flustered due to the challenges posed by uncooperative infants and the extended time required for examinations<sup>[1,2]</sup>.

### Quality Assurance

Quality assurance holds a pivotal role in the realm of paediatric radiography. Attaining high-quality images is crucial in radiography, demanding skilled technologists and optimal performance from imaging equipment. Accurate diagnosis of numerous paediatric conditions relies on precise depiction of tissue characteristics and subtle variations. Regular quality assurance initiatives and evaluations are essential for maintaining peak performance, often entailing ongoing equipment calibration. Implementing double-check protocols is vital to prevent any potential missed diagnoses<sup>[1,2]</sup>.

### Patient Positioning

Among paediatric examinations, inaccurate and improper positioning stands out as the primary culprit behind subpar radiographic image quality. This should not serve as a justification for inadequate image quality<sup>[9]</sup>. The suitability of an image for diagnosis hinges on the specific clinical inquiry, and there could be scenarios where a slightly lower image quality suffices for certain clinical needs. However, compromised image quality is only acceptable if it's intentionally designed and is connected with a reduced radiation dose for the patient. Strategies to ensure accurate positioning of paediatric patients in radiology include utilizing age-appropriate positioning aids, employing immobilization techniques when necessary, engaging child life specialists to ease anxiety and cooperation, using clear and concise communication with both the child and caregiver, and implementing specialized training for technologists dealing with paediatric cases<sup>[10]</sup>.

### Here are the key guidelines for paediatric imaging departments:

1. Justify each procedure clinically.
2. Weigh benefits against risks.
3. Avoid using adult facilities for children.
4. Customize protocols for each case.
5. Ensure coverage for scheduled and urgent cases.
6. Follow radiation protection with ALARA principle.
7. Staff should understand paediatric anatomy and pathology.
8. Experts need comprehensive knowledge of techniques, including uses and risks.
9. Understand pros and cons of each imaging method for informed decisions.
10. Strong communication skills are crucial for working with children.
11. Maintain access to interventions and emergencies.
12. Prioritize child safety in all protocols.

### Factors contributing to positioning challenges :-

- **Anatomical Variability:** Children's anatomy is still developing, leading to size variations and differences in bone density and structure. This can make it difficult to position them accurately for imaging procedures.
- **Limited Tolerance:** Children often have shorter attention spans and limited ability to remain still for extended periods. This can result in motion artifacts that compromise image quality.
- **Fear and anxiety:** The radiology environment can be intimidating for children, triggering fear and anxiety. This emotional state can hinder their cooperation and ability to follow positioning instructions.
- **Communication challenges:** Younger children might not fully understand instructions, while older ones may be too anxious to comprehend. Effective communication with both the child and their parents is crucial for

cooperation.

- **Cooperation and compliance:** Unlike adults, children might not understand the necessity of staying still during imaging. This lack of comprehension can lead to non-compliance, affecting the quality of the images.
- **Cognitive Development:** Cognitive development varies across different age groups. Toddlers, school-age children, and adolescents all have distinct cognitive abilities that impact their understanding of the imaging procedure.
- **Sensory sensitivity:** Children can be sensitive to unfamiliar sensory experiences, such as the sounds, smells, and sensations associated with imaging equipment. These sensitivities can cause distress and hinder cooperation.
- **Parental involvement:** Parents play a significant role in comforting and reassuring their children during imaging. However, parental anxiety can sometimes transfer to the child, exacerbating positioning challenges.
- **Immobilization devices:** Immobilizing children without causing discomfort or distress can be challenging. Striking a balance between restraint and comfort is essential for successful positioning.
- **Medical conditions:** Children with medical conditions, physical disabilities, or sensory sensitivities might require specialized positioning techniques and equipment.
- **Time constraints:** Paediatric imaging often needs to be completed quickly due to children's limited attention spans and potential scheduling constraints in a clinical setting.

#### **Solutions for positioning challenges :-**

##### **Immobilization devices**

An immobilization device serves the crucial purpose of ensuring that patients remain perfectly still during medical examinations, preventing any movement that could lead to image blurring. Patient motion can be categorized into two types: voluntary and involuntary. Immobilization techniques focus on minimizing voluntary motion, while brief exposure times are effective against intrinsic motions. These devices are designed to effectively maintain the patient's intended position. Some examples of immobilization devices include:

- ❖ Tam-em board
- ❖ Pigg-O-Stat
- ❖ Sandbags
- ❖ Velcro strips
- ❖ Tapes
- ❖ Towels

The proper implementation of immobilization procedures significantly enhances the quality of medical images, reduces the duration of tests, and minimizes the need for additional follow-up examinations. Achieving effective immobilization may involve the use of various materials, such as adhesive tape, foam rubber blocks, wedges, sheets, towels, diapers, stretch gauze bandages, orthopaedic stockinet, and wood blocks. By employing these materials judiciously, healthcare professionals can maintain optimal patient positioning and contribute to successful diagnostic imaging outcomes<sup>[2]</sup>.

##### **Communication strategies**

Effective communication in paediatric radiography plays a pivotal role in alleviating anxiety and enhancing cooperation for both the child undergoing the procedure and their parents. By establishing a warm and empathetic rapport, healthcare providers create a trusting environment that reassures both parties. Clear and simple explanations of the procedure help demystify the unfamiliar medical setting, reducing uncertainty and minimizing anxiety. Addressing any concerns or fears promptly through open communication channels further contributes to a positive experience. By involving children in the decision-making process, such as choosing a preferred position or participating in distraction techniques, communication empowers them and offers a sense of control. Parents' involvement in these discussions not only reassures their child but also equips them to play an active role in calming their child's nerves and encouraging cooperation. Ultimately, effective communication serves as a bridge, fostering understanding, trust, and a collaborative approach that leads to

successful paediatric radiography outcomes<sup>[11]</sup>.

### **Distraction techniques**

Using play and distraction techniques in healthcare is getting more common. People who are experts in these techniques are called play specialists. They usually work with kids in hospitals and clinics, but not as much in places where medical images are taken. It's a good idea to involve them to understand what kids need in radiology departments. Play specialists would be happy to talk to other healthcare workers about making hospitals more kid-friendly and using ways to distract kids<sup>[2,12]</sup>.

### **Sedation and Anaesthesia**

Sometimes, it might be needed to think about giving medicine to make a child feel relaxed. The doctors will carefully check if the child's pain is under control, especially if the child has injuries in their bones or soft tissues. Giving medicine to make a child feel relaxed is not done often, but it might be needed to help the child feel less pain, fear, and worry. If the doctors decide to use this medicine, they will plan the X-rays and other pictures, like CT scans or MRIs, to be taken while the medicine is working well. This way, the child can get the most help from the medicine<sup>[13]</sup>.

### **Parental involvement**

Parental involvement plays a crucial role in the realm of paediatric radiology due to its profound impact on the well-being and experience of young patients. When parents are present during radiological procedures, their comforting presence helps alleviate the natural anxiety and fear that children often experience in medical settings. This emotional support not only provides a sense of security for the child but also facilitates cooperation, enabling them to remain still and calm during the procedure. Parents serve as effective communicators, explaining the process in familiar terms and soothing the child's concerns. Beyond immediate comfort, parental involvement also contributes to building trust between the child, their family, and the medical team. By being advocates for their child's needs and preferences, parents ensure that the child's unique requirements are considered. This involvement aids in accurate medical history sharing, which is crucial for informed decision-making. Furthermore, parents continue to offer solace post-procedure, contributing to the child's overall positive experience. In essence, parental involvement not only eases the child's journey through radiology but also strengthens the bond between medical professionals and families, fostering a collaborative approach to healthcare that ultimately benefits the child's physical and emotional well-being<sup>[14]</sup>.

## **III. CONCLUSION**

In conclusion, the challenges encountered in paediatric radiology positioning pose significant hurdles to both medical practitioners and young patients. These challenges, ranging from patient cooperation to image quality concerns, underscore the need for innovative solutions that prioritize the well-being of children undergoing medical imaging. Through meticulous research and analysis, this article has highlighted several effective solutions, each addressing specific positioning issues. Customized positioning aids, distraction techniques, and tailored communication have emerged as practical strategies to enhance patient comfort and cooperation. Furthermore, collaboration with play specialists, parental involvement, and proper training can empower healthcare professionals to navigate these challenges successfully. It is evident that a comprehensive approach, blending technical expertise with compassionate care, is essential to mitigating the obstacles inherent in paediatric radiology positioning. By implementing these solutions, medical practitioners can foster an environment that minimizes stress and anxiety for young patients, ensuring accurate diagnoses while nurturing a positive experience. As the field of paediatric radiology continues to evolve, the integration of innovative strategies remains pivotal in optimizing both medical outcomes and the holistic well-being of the youngest members of our society.

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