Literature Review

Keeping Children Still in Medical Imaging Examinations- Immobilisation or Restraint: A Literature Review

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ABSTRACT

Purpose: In paediatric imaging, it is common practice to hold children still for an examination by using immobilisation devices, parents, and/or staff. Historically, there has been a perceived need to restrain a child against their will when uncooperative behaviour was demonstrated. The issue of patient consent and use of physical force forms this fundamental difference between “immobilisation” and “restraint”. To avoid unknowingly “restraining” a child, the factors affecting a radiographer’s decision to “restrain” are explored in this literature review from a child’s rights and radiation protection perspective.

Method: Literature searches were performed using the primary keywords “paediatric”, “immobilisation”, “restraint”, and “medical imaging”. Titles, abstracts, and full texts were screened for their relevance and resulted in 16 articles to address the aims of this literature review.

Results: The literature discussing immobilisation and restraint in paediatric imaging includes 16 articles published between 1980 and 2017. The literature findings were categorised, analysed, and discussed under the five subtopics: definitions of immobilisation and restraint, consent and children’s rights, paediatric radiation protection, radiation dose to parents and staff, and the future implications of restraint in medical imaging.

Conclusion: Many factors, including the justification of the examination, the rights of the child, the child’s cooperative ability, and the radiation doses to the patient and accompanying persons, mean the decision to restrain may be a difficult one to make. The introduction of guidelines and training in Australia would prove useful in assisting this decision-making process. An individual assessment of the child’s best interests and family’s needs must be considered; however, restraint should ideally be avoided unless justified through a risk-benefit analysis.

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RÉSUMÉ

But : En imagerie pédiatrique, il est pratique courante de maintenir l’enfant en utilisant des dispositifs d’immobilisation, les parents ou des membres du personnel. Historiquement, il y a eu un besoin perçu de maintenir un enfant contre sa volonté lorsque celui-ci a un comportement non coopératif. La question du consentement du patient et de l’utilisation de la force trace la différence fondamentale entre l’immobilisation et la contention. Pour éviter la contention involontaire d’un enfant, les facteurs ayant une incidence sur la décision d’un radiographe d’utiliser la contention sont examinés dans cette revue documentaire du point de vue des droits de l’enfant et de la radioprotection.

Méthodologie : Une recherche documentaire a été effectuée avec les mots clés primaires « pédiatrique », « immobilisation », « contention » et « imagerie médicale ». Les titres, les résumés et le texte complet ont été triés selon la pertinence et 16 articles ont été retenus pour les fins de la revue documentaire.


Conclusion : Puisque plusieurs facteurs sont en jeu, incluant la justification de l’examen, les droits de l’enfant, la capacité de coopération de l’enfant et la dose de rayonnement pour le parent ou l’accompagnateur, la décision de recourir à la contention peut être difficile à prendre. La mise en place de directives et de formation en Australie serait utile pour aider à ce processus décisionnel.
Comme toujours, une évaluation individuelle de l’intérêt de l’enfant et des besoins de la famille doit être envisagée; cependant, la contention devrait idéalement être évitée à moins qu’elle ne soit justifiée par une analyse des risques et des avantages.

Keywords: Immobilisation; restraint; paediatric; medical imaging

Introduction

Paediatric imaging is often seen as an area of specialty requiring extensive knowledge of imaging protocols and radiation dose [1]. In Australia, paediatric imaging includes infants, children, and adolescents under the age of 18 years [2]. Specifically in New South Wales and South Australia, a child’s consent to health care is legal from the age of 16 years [2]. This demographic not only presents with different radiographic anatomy but also with different communication and emotional needs compared with adults [3]. Radiographers are often put into situations where a child’s needs must be understood in a short amount of time for smooth completion of the examination [4,5].

In an unfamiliar x-ray or CT room, paediatric patients can easily become anxious and uncooperative. Further heightened by pain and discomfort from trauma or illness [1], this behaviour in children can present as crying and refusing to remain still for the scan. Thus undiagnostic images with severe motion artefact often result from the child’s movement which requires repeat imaging. The primary issue with repeat imaging, however, is the biological effects of ionising radiation on the child.

As x-rays interact with water molecules to form free radicals in the body, there is a potential for pathological malformation to occur [6]. This risk is seen to increase by tenfold in paediatric patients, with the highest risk occurring in the youngest of patients [7,8]. Increased radiosensitivity can be explained by rapid DNA cell division and a longer life expectancy in children, which results in increased susceptibility to mutation and chances of a latent effect, respectively [8]. Although other factors can affect repeats in paediatric imaging, 48% of radiographers believe that patient motion is the largest contributor to unnecessary dose [9]. Taking the radiation dose into consideration it is essential for radiographers to use techniques to ensure the paediatric patient remains still for the duration of the scan.

Various techniques such as physical holding, distraction, and sedation are commonly used in paediatric imaging to minimise patient motion [10]. Distraction appears useful for diverting the child’s attention away from pain, whereas sedation induces sleep, thereby ensuring that the child remains still. Specifically for physical holding, the radiographer, the parent, or an immobilisation device can be used to hold the child still [10]. In paediatric imaging, the literature describes immobilisation as an essential technique for diagnostic image quality and, thus, for reducing the radiation dose associated with repeats [11–14]. The need to minimise radiation dose may be deemed to be in the “best interests” of the child by radiographers; resulting in children being frequently restrained against their will [15]. This allows radiographers to fulfill their duty of care by protecting the child from potentially harmful radiation. However, the issue of patient consent arises as the Australian Human Rights Act (1986) states that children have the right to be heard and respected for decisions involving them [2]. When these rights are neglected and physical force is used to overpower the child, the paediatric patient can receive physical injuries such as skin tears and bruises [16]. These injuries can easily be overlooked because bruises and skin tears may only develop after the child has left the imaging department, leaving radiographers unsure of the weight that these risks carry.

Brenner also highlights that physical restraint can affect both the child and accompanying parent emotionally and psychologically, portrayed through severe anxiety, distress, and a loss of faith in the health care system [17]. Naturally radiographers will want to avoid these negative effects on the child and parent; however, when paediatric radiation protection is the priority, consideration of physical and emotional injuries may become secondary. Therefore, an exploration of this mindset is a necessary first step to balancing the importance of minimising paediatric radiation dose, maintaining the child’s physical safety and managing the child and parent’s emotional states.

These issues are explored in the Royal College of Nursing guidelines [18]; however, as radiography-specific guidelines currently do not exist, it can be difficult to extrapolate into imaging examinations as radiographers must also consider radiation dose in accordance with the “as low as reasonably achievable” (ALARA) principle. To provide a first step to reflection and implementation of best practice in paediatric imaging, this literature review aims to define immobilisation and restraint in the imaging context, explore the factors affecting the decision to restrain in medical imaging (children’s rights, radiation protection of the child, parents, and/or staff), and highlight any future directions for Australian paediatric imaging.

Methodology

Searches through the databases Scopus, PubMed, Ovid MEDLINE, and Google Scholar were performed. Variations of the primary keywords “p(a)ediatric”, “immobilisation”, “restraint”, and “medical imaging” were used. This initial literature search found Scopus to contain the largest variety of relevant articles (n = 1392), prompting a more thorough search through the database. Further keywords “consent”, “children’s rights”, “dose”, and “radiation protection” were then added to the Scopus search. Articles with the keywords “fracture immobilisation”, “spinal immobilisation”, and restrained against their will [15]. This allows radiographers to fulfill their duty of care by protecting the child from potentially harmful radiation. However, the issue of patient consent arises as the Australian Human Rights Act (1986) states that children have the right to be heard and respected for decisions involving them [2]. When these rights are neglected and physical force is used to overpower the child, the paediatric patient can receive physical injuries such as skin tears and bruises [16]. These injuries can easily be overlooked because bruises and skin tears may only develop after the child has left the imaging department, leaving radiographers unsure of the weight that these risks carry.

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“seatbelt” were excluded as this type of immobilisation focussed on treatment after trauma and motor vehicle accidents rather than the use of immobilisation in an imaging examination. Keywords related to psychiatric and dental professions were excluded as the reasons for restraint did not specifically focus on x-rays and radiation protection. Nuclear medicine articles were also excluded as different methodologies may be used to achieve an optimal scan. In addition, limiting criteria to include articles and reviews in English were applied. The titles and abstracts were then screened for their relevance to the topic, leaving 27 relevant articles and reviews. After a full-text screen, 16 articles were included to address the aims of this literature review. Figure 1 highlights the screening process to obtain the final articles.

Results
The literature discussing immobilisation and restraint in paediatric imaging includes 16 articles published between 1980 and 2017. The 16 articles comprise of quantitative research studies (n = 7), reviews (n = 8), and hospital audits (n = 1). Articles were not limited by date as paediatric restraint has remained an issue since the 1950s, with increasing awareness within the last 30 years (Figure 2).

Analysis and Discussion
In general, the research articles focussed on the use of immobilisation techniques in different aged paediatrics [10,19,20], the effect on image quality when an immobilisation device is used [12,21], and the effects on staff and parents when holding the child [22–24]. Aside from two review articles discussing radiation protection [8,13], the remainder explored children’s rights, consent, and legal issues surrounding paediatric restraint in medical imaging [4,5,11,14–16]. As consent and legal issues are difficult to explore through research, review articles summarising legal documents and legal acts were deemed necessary to include in this literature review. The literature findings were categorised into five sections:

i. definitions of immobilisation and restraint,
ii. consent and children’s rights,
iii. paediatric radiation protection,
iv. radiation dose to parents and staff,
v. the future implications of restraint in medical imaging.

i. Definitions of Immobilisation and Restraint in the Medical Imaging Context
The literature consistently defines immobilisation as rendering a child incapable of moving with the child’s consent [4,10,15,19,20]. In medical imaging, immobilisation is used to keep a child still during fluoroscopic, x-ray, and CT examinations to avoid increased radiation dose to the child due to motion artefact and, therefore, repeat imaging.

Used for the same reasons, restraint is defined as the use of physical force to stop the movement of a child without the child’s consent [4,10,15,19,20]. Since the use of force can harm patients physically through skin tears and emotionally through anxiety and fear of future radiographic examinations [16], an article suggests using restraint as a last resort and for 5-10 minutes at a time [4,16]. Therefore, it can be seen that “immobilisation” and “restraint” vary in two aspects: patient consent and the use of physical force.

In Australia, keeping children still is frequently performed using Velcro straps, distraction, sandbags, and physical holding by parents and/or staff [10]. Across three studies published in Australia, Kuwait, and the United Kingdom (UK), parental holding is the most common technique for ensuring the child remains still [10,19,20]. Parental holding is advantageous due to the parent’s ability to influence the emotions of the child, thus being able to reduce the child’s anxiety [11,16]. However in examinations where the parent is more anxious than the child, this may prove counterproductive.

Distraction techniques using toys, blankets, and verbal communication is commonly used in Australia for 2- to 3-year-old children in x-ray and 4- to 5-year-old children in CT and MRI [10]. Compared with other restraint techniques, distraction does not require the use of physical force, thereby falling into the “immobilisation” category. This proves effective for avoiding physical injury to the child and emotional trauma during future radiographic examinations. However in general x-ray, parental or staff holding is still seen to be preferred over distraction [10]. This may be explained by the fact that distraction is only effective to a certain degree as children adamant on not having the scan or lacking the understanding to cooperate may not respond well to distraction.

From the definitions previously discussed, immobilisation devices can either fall into a category of “immobilisation” or
“restraint” depending on how it is used and how much force is applied to the paediatric patient. As the Pigg-O-Stat (Figure 3) completely encapsulates the child, this force can amount to “restraint”, whereas the Fuller Chair (Figure 3) uses Velcro strapping and only imparts force on the necessary joints thereby falling under “immobilisation”. Therefore, balancing the amount of force to avoid “restraint” yet justifies the use of the device is essential but difficult to achieve [5]. The inability to control the amount of force in commercial immobilisation devices could be the reason for its minimal use in Australia, the United Kingdom, and Kuwait [10,19,20].

In this literature review, five articles define a difference between immobilisation and restraint, with the remaining articles using the two terms interchangeably. In particular, articles focussing on paediatric radiation dose effects and optimal image quality techniques do not define the two terms and aspects of patient consent are not discussed. Moreover, Hardy and Armitage’s article [15] states that in health care practices such as radiography, “restraint” is more commonly used compared with “immobilisation”. Perhaps since restraining patients is the norm in an imaging department, a notion that they are in fact interchangeable has evolved. An Australian pilot study highlights that 67% of Australian
radiographers routinely immobilise or restrain paediatrics in everyday practice [10]; therefore, the lack of awareness in the difference between “immobilisation” and “restraint” becomes an issue. Similar studies demonstrate values of 83% and 69% for UK and Kuwait radiographers, respectively [19,20]. Since immobilisation is frequently used in everyday practice, it becomes essential to pinpoint whether it is truly “immobilisation” or “restraint” that is being undertaken. However it can be difficult to define clear lines between the two terminologies as the amount of force used is difficult to quantify in practice. As there is no existing data for a standard amount of force considered to be “safe” for immobilisation, further exploration and research into the physical force aspect of paediatric restraint is warranted. Therefore, currently the only way to define “immobilisation” and “restraint” medical imaging lies within gaining patient consent to touch before immobilising the child.

ii. Further Defining “Immobilisation” and “Restraint”: Consent and Children’s Rights

Consent must be sought before commencing any imaging examination to meet legal requirements [26]. However, consent for touching or holding a paediatric patient is rarely considered and often implied [19]. This is demonstrated in Graham and Hardy’s study [19] which found that 99% of UK radiographers do not consider consent as a factor for restraint. A survey methodology bias where “consent” was not an option on the survey could have affected this value; nevertheless consent for physical contact remains an issue. Legally, touching a child without consent even when no harm is applied can be considered “battery” in Australia, England, and the United States [4,27]. Therefore, it is always important to ensure consent is gained from the child before physical contact. Not only this, but uninformed parents may perceive immobilisation as an offense of battery; therefore, effective communication with the child and parent is vital before immobilising. It is further suggested that immobilisation devices and imaging equipment should be explained to the parent and child, with emphasis placed on the child’s safety [4,11].

However, the process of gaining consent for immobilisation may not be an easy task as radiographers are required to judge the child’s competency and the child’s ability to understand the given information. Studies highlight that the use of restraint decreases with age [10,19] due to the child’s ability to comprehend examination instructions. At the age when paediatric patients are able to make their own informed decisions, they are termed “Gillick competent” [4,15]. This terminology has been adopted into Australian law by the High Court of Australia [28,29] with Victorian legislation stating that a child can refuse restraint if the medical practitioner/radiographer deems the child competent [30]. This is an issue as the assessment of Gillick competency can vary based on the radiographer’s ethical beliefs and morals [15]. Moreover, a radiographer’s ability to accurately discern competency from incompetency in paediatrics remains unknown. Graham and Hardy’s study and Dashti et al.’s study demonstrate that when radiographers deem a child unable to understand, 82% and 81% of UK and Kuwait radiographers are seen to restrain, respectively [19,20]. This can highlight a tendency to automatically ignore consent and a child’s rights when cooperation is not gained. Therefore, Hardy and Armitage [15] suggest that radiographers must first assume Gillick competency to avoid the assumption that a child is unable to consent.

In neonate and infant examinations where competency is disproved, parental consent is often sought. In these situations, parents are able to make decisions on behalf of the child or infant provided that it is in the child’s best interests [28]. In cases where children are Gillick competent and their decision to give or refuse consent does not align with their parent’s, the court of law is able to clarify which decision is truly in the child’s best interests. This is demonstrated in Marion’s case in 1992, where Australian law judged Marion competent to refuse surgery at 13 years old, despite the decision being different from her parents [29]. Noonan et al.’s study [10] also discusses that despite having parental consent, holding can still result in “restraint” if the child does not consent. Therefore, since radiographers also have the responsibility to act in the child’s best interests, they are not required to act solely on the parent’s wishes [15].

According to Article 12 from the United Nations Convention on the Rights of the Child, children have the right to express their opinion and be heard regarding decisions involving their own wellbeing [31]. This highlights that a child refusing to be restrained has the right to be heard and respected. Furthermore Article 3 from the Convention on the Rights of the Child and the Australian Human Rights Commissions Act (1986) [2,31], highlight the radiographer’s responsibility to also act in the child’s best interests. Therefore in a radiographic procedure, the child’s best interests should be considered while respecting their voice and ability to express their wishes [2,31]. This will allow for appropriate consent to be gained, thereby assisting in creating a clearer distinction between “immobilisation” and “restraint” in paediatric imaging.

iii. The Issue in Medical Imaging: Paediatric Radiation Protection

Paediatric patients are more susceptible to stochastic effects of ionising radiation as past literature has discovered that children are twice as sensitive to developing leukaemia [8]. Not only this, but the risks of breast cancer and thyroid cancer can be increased by factors of 3 and 4, respectively, in the later years of the child’s life [8]. Taking into consideration cumulative radiation exposure to future imaging procedures, unnecessary radiation must be avoided for these effects to be kept at a minimum. Techniques to reduce radiation dose in paediatric radiography are often understood as reducing exposure time, decreasing exposure factors, and increasing the source.
However an important method for minimising patient dose that cannot be overlooked is immobilisation of the paediatric patient [12]. Through immobilisation, motion artefact can be avoided, thereby producing a diagnostic image without the need for repeat exposures [10,11].

In medical imaging, a diagnostic image is defined by the Council of European Communities as an image that is able to address any clinical indication [34]. Motion artefact can result in the inability to answer the clinical question, thereby making images undiagnostic. As such, many articles describe a “successful” paediatric examination as one with no patient movement [4,5,14,16]. European guidelines further support this idea of “success” by stating that the positioning of the patient must be exact despite uncooperative behaviour [15]. Furthermore, Kohda et al.’s study [12] has shown that the use of immobilisation is effective for achieving diagnostic image quality, with findings that an immobilisation device can improve image quality by 14 times in paediatric chest radiography. Another study by Reilly et al. [21] found that magnetic resonance images were diagnostic 95% of times when paediatric immobilisation was used. Although the values of these two studies cannot be compared, the importance of immobilisation in diagnostic imaging is highlighted. With effective immobilisation, chances of acquiring a diagnostic image on the first exposure is increased, thus reducing the need for a repeat examination. However, because classifying an image as “diagnostic” is often subjective, there can be cases where a radiographer’s standard of “diagnostic” is higher than a radiologist’s standard. This may result in repeat imaging due to radiographers deeming the images undiagnostic. Therefore, once images with motion artefact have already been taken, it is ideal to check with a radiologist before re-exposing the paediatric patient.

Another important factor for minimising paediatric radiation dose is the necessity of the examination. The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) Code of Practice states that a radiological procedure must be justified before commencing an examination [35]. A survey highlights that 80% of radiographers perform restraint as they have deemed the examination essential for the child’s treatment [19]. It is unknown, however, how well radiographers are able to justify an examination and whether all risks and benefits have truly been considered. The inability to identify an unnecessary examination can be fatal as the radiation dose and restraint, if used, will also be deemed unnecessary. It is reported that 25-35% of paediatric CT examinations are unnecessary [8] suggesting that if paediatric restraint was used in these 25-35% of examinations, restraint cannot be justified. Therefore, immobilisation and restraint can only be argued to minimise radiation dose if the examination has first been deemed necessary.

Moreover as immobilisation is seen to result in decreased radiation dose, the mindset that it is “essential” in every paediatric examination emerges. This is demonstrated by 88% of UK radiographers whose purpose for immobilising in everyday practice is the child’s radiation protection [19]. With this mindset, however, radiographers can be influenced to “restrain” rather than “immobilise” with the justification of radiation protection being in the child’s best interests. Hardy and Armitage [15] provide a perspective that this idea of the child’s best interests can easily be skewed by the radiographer’s attitudes and beliefs, highlighting the need for radiographers’ to be aware of the attitudes and beliefs that are held. This belief that radiation protection justifies restraint must also consider the degree of physical and mental injury that can occur when restraining a paediatric patient [4].

iv. Using Parents and Staff to Immobilise: What Are the Implications of Radiation Dose?

When dealing with uncooperative children, direct physical holding is frequently used as an immobilisation technique in the general x-ray department. In Australia, 89% of radiographers prefer parental and/or staff holding, particularly for 0- to 3-year-old children [10]. This value is seen to decrease to 74% in 4- to 5-year-old children and drops significantly to 7% in 13- to 17-year-old children [10]. Breathing techniques are then seen to be used in 9- to 17-year-old children [10], supporting the notion that older children are able to understand instructions and explanations to allow for cooperation. Therefore, it is seen that the issues surrounding physical holding most commonly arise in examinations involving Gillick incompetent children.

In general, the literature does not seem to agree on the use of parents when immobilising the child. Articles are seen to emphasise the effectiveness of parental holding in decreasing the child’s anxiety and assisting in radiographic positioning, in the hope that parents will adjust the amount of physical force to avoid “restraint” [11,14,16]. This proves beneficial from a legal perspective as parents will not be given an opportunity to misinterpret the radiographer’s techniques as “restraint” [11]. However, the use of parents is challenged by a study highlighting the preference of radiographers to hold the child themselves [23]. This preference stems from the observation that parents can be unwilling to hold the child too firmly in case of further injury to the child, resulting in inadequate patient positioning [23]. From a radiation dose prospective in situations where the parent is unable to effectively immobilise and a repeat is still required, the radiation dose and scattered radiation will double for the paediatric patient and the parent, respectively [24]. However, it is noted that this can be avoided by providing clear instructions and an explanation for the importance of proper patient positioning to the parent in the first place [23].

Two articles appear to agree on not using radiographers for immobilisation [22,24]. The International Commission on Radiological Protection’s international recommendations support this by stating that radiographers should only be used in “exceptional circumstances” in consideration of cumulative exposure from other areas such as from the operating theatre [36]. Furthermore, findings from a hospital audit reveal that radiographers are seen to hold babies 84 times a month
Even with lead protection, the radiation dose to accompanying staff is seen to reach 0.033 mSv for a 2-projection chest examination [22]. As radiographers’ annual limits are 20 mSv according to ARPANSA [37], holding babies 84 times a month for a chest x-ray can result in a yearly dose of approximately 33 mSv. This puts into perspective that the annual dose limit can easily be reached through cumulative exposures. However as these effective dose values date back to 1985, its relevance to current clinical practice is limited due to the advances in radiographic technology and the increase in awareness of radiation protection in the last 30 years. This suggests a need for more recent audits and further exploration into the effective doses for accompanying persons.

As parents and the general public have an annual dose limit of 1 mSv according to ARPANSA [37], utilising parents for holding is also not ideal. However, in cases where direct physical holding is required, a decision between parental or staff holding must be made. The cumulative radiation dose to radiographers every year during their working life must be considered alongside the radiation dose to parents from holding their child (or other children) occasionally and from their own imaging. Therefore, it could be useful to briefly gauge the parents’ visit frequency to medical imaging before making a decision.

Ideally other means of immobilisation should be used such as blankets, Velcro straps, and distraction techniques. This would allow for ALARA to be maintained as radiographers and parents would receive less scattered radiation. Appropriate explanations and positive encouragement for the child can further avoid issues of “restraint” when using immobilisation devices and distraction [11]. This encouragement can come from parents while they stand behind the lead screen to keep their child company from a distance. As 75% of parents are uncomfortable leaving their child to enter the examination alone [23], it is still ideal to bring the parent into the examination room with their child. However, as physical holding comes with risks of radiation, the need to use parents and staff must be considered with the understanding that alternatives such as blankets, pillows, Velcro straps, and distraction techniques are available. As always, each family should be taken as a case-by-case basis and parental holding should only be used for special cases involving children with disability [23]. It is also noted that a male parent is preferred as the physical “holder” over a child-bearing aged female parent to maintain radiation protection for possible future children [16]. Otherwise alternatives can be used to immobilise the child without any radiation risks to parents and staff.

v. Future Implications: Overcoming Issues Associated with Restraint

Articles have highlighted a lack of education in the field of paediatric imaging in relation to the increased tendency of radiographers to overestimate paediatric exposure factors [13]. This may be due to an increased focus on adult imaging, leaving paediatric imaging for specialist centres. However, many babies, infants, and children still present to nonpaediatric departments and require special attention. Noonan et al.’s study [10] reveals that 75% of radiographers in nonpaediatric facilities were dissatisfied with the equipment available specifically for paediatric immobilisation, demonstrating a need to explore the equipment in nonpaediatric facilities and standardise paediatric best practice.

Furthermore, the aspect of restraint in paediatric imaging appears to be lacking awareness in both paediatric and nonpaediatric facilities, particularly the risks and benefits involved. It appears that currently no articles consider every aspect of restraint: radiation dose to the patient, patient consent, children’s rights, and the effects of restraint on the child. As previously discussed, prioritising one aspect over another can risk increasing the child’s radiation dose or the emotional and physical harm.

In situations where restraint must be used, it may be difficult to come to a conclusion on the best method for restraint and how to best minimise these potential risks of restraint. The Royal College of Nursing have published restraint guidelines for nurses that encompass the consideration for children’s rights and legal concerns providing clarity for nurses when making decisions regarding restraint [18]. However, as these guidelines do not take into account a radiographer’s dilemma of radiation protection, it is difficult to extrapolate into medical imaging. Graham and Hardy [19] have also indicated a lack of awareness regarding the availability of restraint guidelines as 27% of radiographers believed guidelines were available; however, they were in fact nonexistent. An Australian study further demonstrates that 53% of radiographers did not have department protocols for immobilisation, whereas 25% were unsure of its existence [10]. This highlights that more clarity and focus should be placed on children’s rights in medical imaging, as the focus has always been to achieve optimal radiographic images according to ALARA under all circumstances [4]. Therefore, multiple studies and articles have concluded that there is a need for radiography-specific restraint guidelines and additional training in paediatric immobilisation techniques [10,16,19,20]. In particular, the study based in Kuwait discovered that 78% of radiographers would benefit from guidelines and 89% from training in paediatric restraint [20]. Implementation of guidelines and training will enable risks and benefits of restraint to be further understood, allowing radiographers to better distinguish whether restraint is necessary or can be avoided. Ideally restraint should be avoided completely in paediatric imaging with literature supporting that distraction techniques and play therapy are effective alternatives [19–21]. Since only 8% of UK radiographers are trained in distraction techniques, it is not surprising that distraction is only being used “sometimes” as discovered by Graham and Hardy’s survey [19]. Therefore, training programs for restraint alternatives is an area for exploration as this could result in lessened restraint and physical holding in medical imaging.

In the International Atomic Energy Agency’s Safety Standards, it is stated that protocols should be created to define when to use restraints, alternatives to avoid direct physical
immobilisation, and clarification on who should hold the patient if this was required [38]. This publication is specifically relevant in Australia as ARPANSA works closely with the International Atomic Energy Agency. Furthermore, because many experienced radiographers may be comfortable with their technique in paediatric imaging, it may be difficult to introduce new holding techniques. Particularly if parental or staff holding is frequently used in the department, this could mean unwillingness to learn how to use a new immobilisation device or new distraction techniques. Therefore, it may be beneficial to include definitions of immobilisation and restraint and the related concerns within the protocols. Through the understanding of the risks involved with restraint, this approach may prompt new inventions and techniques to minimise radiation dose in paediatrics while maintaining children’s rights. This of course would indicate the need for further studies and focus to be placed on the area of child restraint in medical imaging [10].

Conclusion

This literature review analysed and discussed the literature relating to immobilisation and restraint in medical imaging from a child’s rights and radiation protection perspective. Although the literature is sparse, recent articles have pinpointed the current mindset of radiographers regarding restraint. There has been a tendency for radiographers to restrain with the intention of it being in the child’s best interests to avoid unnecessary radiation. As radiation protection is the goal, often the child’s rights and consent are overlooked. This forms the distinction between “immobilisation” and “restraint” as the literature defines “restraint” as keeping the child still without the child’s consent and the use of overpowering force. Conversely, appropriate informed consent from the child and a lack of overpowering physical force forms “immobilisation”. As only a limited number of articles highlighted a difference between the two terminologies, it can be concluded that a general mindset understands “forceful holding” to be synonymous with “consented holding”. From this the problem of unknowingly neglecting a child’s rights to be heard and respected when refusing restraint arises. The risks of overlooking children’s rights and causing physical and mental harm must be analysed against the benefits of decreased radiation dose. This allows for all aspects to be considered before making a decision to restrain. It must also be considered that unsuccessful restraint may still result in two exposures being taken, contradicting the justification of radiation protection. Furthermore, in cases where images are not “perfect”, they may still be “diagnostic” to the radiologist, thereby suggesting that restraint may not always be required for a “diagnostic” image. This suggests that a reflection on whether “restraint” is necessary and whether it is ethically and legally appropriate in each examination is required.

Moreover, with many factors in mind including the justification of the examination, the rights of the child, the child’s cooperative ability, and the radiation doses to the patient and accompanying persons, it may be difficult to make decisions regarding restraint in clinical practice. Therefore, the general trend of studies recommends the introduction of guidelines and training for safe immobilisation and distraction techniques. Implementation of such education globally and in Australia would allow for radiographers to develop a deeper understanding for alternatives to restraint, the justification of restraint, and safe techniques in restraining. As a result, this would encourage the use of “immobilisation” instead of “restraint” in medical imaging, which is ideal. As always, an individual assessment of the child’s best interests and family’s needs must be considered; however, restraint should ideally be avoided unless justified through a risk-benefit analysis.

Footnotes

Contributors: All authors contributed to the conception or design of the work, the acquisition, analysis, or interpretation of the data. All authors were involved in drafting and commenting on the paper and have approved the final version.

Funding: This study did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Competing interests: All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: no financial relationships with any organizations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

Ethics approval: Not required.

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