A literature review of ‘best practice’ for radiographers when imaging suspected non-accidental injury or physical abuse of children in Australia and New Zealand

Edel Doyle\textsuperscript{a,b,1,*}, Raymond Vuong\textsuperscript{c}

\textsuperscript{a} Lake Imaging, Geelong VIC 3220, Australia
\textsuperscript{b} International Association of Forensic Radiographers, Australia
\textsuperscript{c} Department of Medical Imaging and Radiation Sciences, Monash University, Clayton VIC 3800, Australia

1. Introduction

Child abuse otherwise known as non-accidental injury (NAI) in Australia and New Zealand, or Suspected Physical Abuse (SPA) in the United Kingdom (UK) and United States of America (USA) is the act in which a child becomes the victim of intentional abuse at the hands of a carer\textsuperscript{[19]} within the family, community or institution which includes homes, schools or medical facilities\textsuperscript{[43]}. There are four main categories: physical abuse, neglect, emotional abuse and sexual abuse\textsuperscript{[10]}. The report published by the Australian Institute of Health and Welfare\textsuperscript{[4]} documented that 146,000 children required further investigation after a notification in 2017–18. Of the substantiated notifications involving 32,000 children, 15\% (n = 4800) related to physical abuse and neglect\textsuperscript{[4]}. SPA/NAI is an issue that exists worldwide, with the homicide rate of children being over 50,000 worldwide annually\textsuperscript{[43]}. Countries such as the USA report over 1500 child casualties each year as a result of SPA/NAI, where over 80\% of victims are under 4 years of age\textsuperscript{[8]}. Some of the articles reviewed have discussed that due to the vulnerability of their smaller size, younger children are at more risk of SPA/NAI than older children\textsuperscript{[8,22]}. Suspicion of NAI is usually triggered if the history provided by the carer does not match the suspected mechanism of injury\textsuperscript{[19]} or if particular injury patterns are identified. These may include multiple fractures, particularly at different stages of healing, or the location of the fractures relevant to the child's age such as rib fractures and classic metaphyseal fractures\textsuperscript{[9,27]}. Hence medical imaging is a valuable investigative tool, often playing a pivotal role in the assessment of suspected SPA/NAI\textsuperscript{[13]} and in helping clinicians make a timely decision to contact child protection services preventing further harm to the patient or their siblings\textsuperscript{[11]}. As part of the legal proceedings involved in the assessment of suspected SPA/NAI, radiographs taken during these examinations will often serve as a legal documentation of the injuries and furthermore will often be used in the court of law as evidence\textsuperscript{[27]}. Consequently this may result in pressure on radiographers involved to maintain their professionalism and to produce images of utmost diagnostic quality. Other forms of medical imaging evidence can include the imaging reports or the expert opinion of the radiologists themselves\textsuperscript{[19,31]}. Although principles of radiography such as ALARA (as low as reasonably achievable) serve as a reminder for radiographers to maintain radiation exposure levels to a minimum during the acquisition of medical images\textsuperscript{[42]}, the expense of increased radiation dose has been recognised as a possible risk in the acquisition of the highest quality radiographs for the detection of clinically occult fractures\textsuperscript{[9,27]} compared to predisposing bone conditions\textsuperscript{[32]}. These may have similar pathological features and can be difficult to differentiate on imaging alone. Radiographers or radiologists involved in medical imaging examinations can be the first healthcare professionals who suspect physical abuse. Therefore knowledge of mechanisms of injuries and injury patterns can assist in the early detection and diagnosis of SPA/NAI. The skeletal survey is generally accepted as the gold standard radiographic examination for imaging of suspected SPA/NAI, but other imaging modalities such as MRI, CT, ultrasound or nuclear medicine imaging can also be applied in the investigation phase\textsuperscript{[25]}. The Society and College of Radiographers and The Royal College of Radiologists (SCOR-RCR), 2018, American College of Radiology\textsuperscript{[1]}. However national surveys that were carried out over the past decade have indicated the presence of many inconsistencies between the protocols of medical imaging departments in terms of which imaging modalities are to be utilised, which projections are required and the required quality of images\textsuperscript{[26]}. This can ultimately result in inconsistent quality of diagnostic images. In the UK, this contentious issue has been addressed with the joint publication by the Society and College of Radiographers (SCOR) and the Royal College of Radiologists (RCR) which was endorsed by the Royal College of Paediatrics and Child Health (RCPCH). Collaboratively they published ‘the radiological investigation of...”

\*Corresponding author.
E-mail addresses: secretary@iafr.org.uk (E. Doyle), rvuo2@student.monash.edu (R. Vuong).
\textsuperscript{1}Present address: School of Health and Biomedical Sciences, RMIT University, Melbourne, VIC 3083, Australia

https://doi.org/10.1016/j.jofri.2019.09.001
Received 9 December 2018; Received in revised form 15 July 2019; Accepted 10 September 2019
2212-4780/ © 2019 Elsevier Ltd. All rights reserved.

Please cite this article as: Edel Doyle and Raymond Vuong, Journal of Forensic Radiology and Imaging,
https://doi.org/10.1016/j.jofri.2019.09.001
suspected physical abuse in children’ with the first edition revised in 2018. These standards outline the procedures and imaging protocols that are now accepted in the UK and across Europe. A similar approach in New Zealand, involving collaboration between eight radiology departments and the University of Auckland’s School of Medicine, results in the development of a national protocol aimed at reducing inconsistencies and improving the quality of skeletal imaging, which in turn it is hoped will yield an increase in diagnostic accuracy [29]. No such national guidelines appear to exist in Australia, hence there are variations in procedural, technical and reporting standards. However hospitals such as The Royal Children’s Hospital of Melbourne (RCH) has published a guideline (undated) on their website which could be deemed as a gold standard radiographic imaging guideline, with other hospitals within the state of Victoria being known to adopt this protocol when required. In Western Australia, the state government [12] has published a diagnostic imaging pathway for NAI which was last reviewed in 2014. In New South Wales, the state guidelines refer to the RCR-SOR guidelines from the UK [24]. The Northern Territory has no published guidelines so this demonstrates lack of consistency across the states and territories in Australia.

2. Methods

The literature search was conducted by using three medical journal and library databases: Scopus, Ovid Medline and the Monash University database. As this is a literature review of best practice for radiographers involved in the imaging of suspected NAI, the main keywords searched included: non-accidental injuries, paediatric, imaging, radiograph and practice.

Keyword searches utilised the appropriate wild card symbols and truncations which broadened the scope of the search. Search limits included the past 10 years and the English language, as there was insufficient time for translation of articles. The search identified a total of 91 papers. The initial filtration of articles involved looking at the country of publication with New Zealand and Australian articles given first preference as this study is to be based on the best radiography practice in these two countries.

The abstracts of the excluded articles were reviewed again and were included if they met any of the following ‘inclusion’ criteria:

- Addressed the role of medical imaging in the assessment of suspected SPA/NAI.
- Discussed the diagnostic or legal process of SPA/NAI.
- Epidemiology of paediatric SPA/NAI.

As the review of imaging guidelines and protocols in the investigation of suspected SPA/NAI to establish best practice was the aim of this literature review, online resources such as published protocols from professional bodies (e.g. ACR, RCR, SCOR, Irish Institute of Radiography and Radiation Therapy (IIRRRT)), hospitals and additional literature sourced from reference lists of the included articles were also reviewed for inclusion.

3. Results

The literature search identified a total of 91 papers. If the article was not published in Australia or New Zealand, it was initially excluded. Two Australian [20,21] and one New Zealand article [29] were identified, however the two Australian articles were deemed irrelevant to medical imaging practice after reviewing the abstracts because they were specific to bone scintigraphy, which is not a part of the skill set of a diagnostic radiographer in Australia; thus they were not included in the study. The New Zealand article was deemed relevant and was included.

The articles that were not published in Australia and New Zealand were analysed again by reviewing the abstracts and applying the inclusion criteria listed above. Of these 88 articles, 17 were deemed to be relevant to the practice of medical imaging in SPA/NAI and were included for background discussion within the review (Fig. 1).

From the literature search it was clear that articles originating from Australia and New Zealand relating to medical imaging of suspected NAI are scarce (n = 1). Neither the professional body for radiologists, The Royal Australian and New Zealand College of Radiologists (RANZCR), nor for radiographers, the Australian Society of Medical Imaging and Radiation Therapy (ASMIERT), have published any imaging guidelines specific to the imaging of suspected SPA/NAI to inform. their members.

4. Discussion

4.1 Imaging protocols

In cases of suspected SPA/NAI, medical imaging is often the first investigation when a medical practitioner is suspicious about a child. Literature has reported that over 80% of SPA/NAI cases are detected using medical imaging, with radiology playing a vital role in the early detection of SPA/NAI as well as the gathering of evidence in cases of death due to SPA/NAI [43]. An emergency department doctor or a general practitioner are usually the first to suspect SPA/NAI following a thorough assessment of the patient [32] in conjunction with their clinical history, which is usually provided by the carer. Causes of suspicion may include injuries which do not fit with the clinical history provided, repeated attendance in seeking medical attention for trauma, inconsistencies in history given and the inability or refusal to provide an adequate explanation for injuries, the last of which is usually seen in carers who fear criminal prosecution or having the child being removed from their care [32].

Research has been conducted on the protocols used in different imaging departments and the results have highlighted the existence of inconsistencies in required projections and standards of image quality [13,26]. A survey conducted by Hulson et al. [13] on behalf of the European Society of Paediatric Radiology (ESPR) stated that having a consensus approach towards imaging of NAI would be beneficial for the following reasons:

![Flow diagram depicting the literature selection process.](image-url)
4.1.1. Skeletal survey

Following the review of protocols and guidelines from countries including the UK, USA, Netherlands and New Zealand and Australia, it can be concluded that the skeletal survey is the gold standard utilised internationally when imaging suspected SPA/NAI, particularly skeletal injuries ([3,40,29,35]). The skeletal survey is undeniably a requirement in the imaging of suspected SPA/NAI, with multiple papers highlighting its significance in assisting with the diagnosis of skeletal injuries, occult injuries as well as underlying genetic diseases of bones and joints [19,23,32]. Typically, a skeletal survey protocol for the imaging of suspected SPA/NAI, will consist of multiple images covering the appendicular and axial skeleton. Table 1 compares three guidelines for the skeletal survey imaging protocol from the ACR-SPR [3], SCOR-RCR [40] and [21] guidelines, as well as the published protocol from the Royal Children’s Hospital in Melbourne [35]. The ACR-SPR and SCOR-RCR guidelines have been nationally and internationally, accepted and adopted in practice in countries such as the USA, UK and other European countries. Apart from the inclusion of a lateral chest and oblique rib projections in the ACR-SPR guidelines, the standard projections in both of these skeletal surveys are identical.

Focussing on the two protocols from Australia and New Zealand, it can clearly be seen that obvious differences exist between them. The New Zealand protocol was based on earlier published guidelines from the ACR-SPR [2] and RCR-RCPC [38], as well as “13 other protocols and 15 articles providing evidence for inclusion of specific images in a skeletal survey” [29]. The final result was a standardised, “two-tiered protocol” which as identified from Table 1, can result in an examination consisting of 17–22 views, depending on:

- The availability of a paediatric radiologist to supervise and
- Whether the patient is an infant or a large and/or uncooperative child

The development of a two-tiered protocol addresses the issue of non-supervised radiographic examinations that were not previously addressed in any guidelines and protocols. Historically, international protocols and guidelines had not considered implementation in smaller centres where radiologists or radiographers with paediatric and NAI experience could be limited, thereby making supervised medical imaging examination an unlikely occurrence. Given the remoteness of some locations in Australia and New Zealand, this is a realistic consideration due to the associated cost and upheaval for the family of transferring a child to a specialist paediatric centre purely for investigative purposes. Whilst RANZCR [34] have published guidelines in relation to the performing of medical imaging examinations in non-dedicated paediatric centres, these do not specifically address SPA/NAI.

Having an experienced paediatric radiologist supervise or made aware of a case of suspected SPA/NAI is recommended by multiple sources ([10,19,25,32,35,40,16]). It is advantageous to the radiographer having a radiologist present to assess the quality of images and to advise regarding the need for additional projections whilst the child is still in the medical imaging department.

The ACR-SPR [2] and RCR-RCPC [38] protocols were analysed and critiqued in the systematic literature review by Phillips et al. [29] utilising the AGREE II appraisal tool. AGREE II is an international tool used to assess the quality and reporting of practice guidelines. It does so by assessing guidelines within six domains [6]:

- Scope and purpose
- Stakeholder involvement
- Rigour of development
- Clarity of presentation
- Applicability
- Editorial independence

Phillips et al. [29] reported that the ACR-SPR Practice Guideline [2] and RCR-RCPC [38] guidelines scored poorly in both domains of rigour of development and applicability, due to insufficient information regarding the development of its protocol regarding whether a systematic review of literature was undertaken and the criteria used to filter the results. Information regarding ongoing auditing or assessment of the protocols was also not included in the guidelines. If assessed against the AGREE II appraisal tool, the RCH protocol [35] would have also scored poorly as no information regarding a systematic literature review or inclusion criteria had been included on the webpage. It is also important to note that as the New Zealand protocol by Phillips et al. [29] was based on the ACR-SPR [2] and RCR-RCPC [38] guidelines, they have acknowledged that there is a limitation to this protocol, in that there is limited evidence to support the inclusion of some radiographic projections.

Many articles have stated that babygrams, a radiograph in which the child’s entire skeleton is imaged in a single radiographic exposure, is no longer considered good practice [10,17,19,27,38]. A babygram does not contribute to the diagnosis of NAI due to the poor image quality, particularly in the assessment of metaphyseal growth plates [7,32,41]. In the UK, babygrams are not accepted in a court of law. In applying the ALARA principle, the cumulative radiation dose from separate projections of the individual joints is lower than a babygram. Hence they are no longer a part of any currently published imaging protocols for suspected SPA/NAI [16,19,23].
4.1.2. Follow up imaging

Occult fractures will often be missed on initial imaging, hence there is a need for follow up imaging [3]. Once a fracture exhibits signs of healing, the appearance of the site of injury will become more apparent on radiographs [40]. Studies have shown that rib and metaphyseal fractures have an increased detection rate of 27% with follow up imaging, although the studies providing these results omitted the oblique rib projection from the original skeletal survey [38]. A follow up chest radiograph after two weeks is usually required for the identification of healing rib fractures through callus formation [19].

The American, British and New Zealand guidelines strongly recommend follow up imaging and acknowledge the benefit of increased sensitivity in diagnosing fractures initially occult on the first skeletal survey. The SCOR-RCR [40] guidelines recommend that the follow-up imaging of all children should be performed between 11 and 14 days and should include chest and rib x-rays, as well as AP projections of the upper and lower limbs. The ACR-SPR [3] guidelines state that follow up imaging “may be indicated” but that a “limited examination could be considered.” The New Zealand protocol recommends repeating “all views, except skull, spine and pelvis (unless those areas were of specific concern)” [29]. The RCH guidelines (2009) did not include follow up imaging as a part of its routine protocol.

4.2. Other imaging modalities

The Royal College of Paediatrics and Child Health [37] and the ACR-SPR [44] have published evidence to support the contribution of other imaging modalities in the investigation of suspected SPA/NAI. Whilst advocating their benefits, it’s also important to be aware of the limitations of alternative modalities, as well as the considerations for the child in terms of radiation dose and time to acquire the images.

4.2.1. Computed tomography (CT)

CT is often the modality of choice for suspected high risk head injuries [28] due to its high sensitivity and specificity in the detection of intracranial haemorrhage and secondary changes such as oedema and infarction [3,10,19,40]. According to an algorithm proposed by Quayle et al. [30], a CT scan of the head should be obtained for children over the age of 12 months if they exhibit neurological symptoms such as altered mental status, focal deficits, seizures or symptoms including vomiting, headaches, drowsiness, irritability, amnesia and a history of altering consciousness. Signs of depressed or basilar fractures also justify CT.

Previous articles and guidelines have advocated that skull radiographs should always be acquired as part of the skeletal survey even if the patient is to have, or has had, a CT of their head [32,38]. Phillips et al. [29] stated that the reasoning behind this is due to the articles being written in a time where CT was less advanced and CT scans were acquired sequentially in the axial plane. Therefore a fracture in the same plane could be missed. However, current guidelines and protocols appear to continue to recommend that skull radiographs remain a part of the skeletal survey [1,40].

In terms of timing of the CT scan, the SCOR-RCR guidelines (2018) state that CT should be performed “on the day of admission, as soon as the child is stable.” This is most likely to be prior to the skeletal survey, particularly in the event where clinical condition demands urgent imaging or if the child presents with a head injury.

Whereas the ACR-SPR [3] practice guideline states that:

- Non contrast CT of the head is indicated in children who have had skeletal survey for suspected child abuse, children with neurological changes, and children with facial injuries raising concern for abuse.
- Non-contrast CT scans of the chest may assist in the identification of rib fractures, whereas contrast-enhanced CT Chest scans are reserved for patients in whom vascular injuries are suspected.
- Contrast-enhanced CT scans of the abdomen and pelvis are recommended for children suspected of having intra-abdominal injuries. The use of oral contrast is determined by the radiologist.

| Table 1: Comparison of NAI skeletal survey protocol guidelines from the USA, UK, New Zealand and Australia. |
|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|
| Axial skeleton                                   | Appendicular skeleton                           | Supplementary projections                        | Townes projections                              |
| Skull                                           | Infants                                         | Coned (both) Wrist                               | Spine                                          |
| Frontal                                         | AP upper limbs (in supination, including hand)  | Coned (both) Knee                                | AP or Lat at sites of abnormalities            |
| Lateral (Lat)                                   |                                                | Coned (both) Ankle                               | AP lower limbs                                 |
| Chest                                           |                                                | Coned projections                                | Orthogonal projections of limbs if fracture is suspected |
| Antero-posterior (AP)                           |                                                |                                               | As requested by radiologist                    |
| Lat                                             |                                                |                                               |                                                |
| Oblique Ribs                                    |                                                |                                               |                                                |
| Inclusion may increase yield of rib fractures   |                                                |                                               |                                                |
| Spine                                           |                                                |                                               |                                                |
| Lat                                             |                                                |                                               |                                                |
| Abdomen/Pelvis                                  |                                                |                                               |                                                |
| AP                                              |                                                |                                               |                                                |
| Appendicular skeleton                           |                                                |                                               |                                                |

E. Doyle and R. Vuong
CT can be used to investigate the severity of complex fractures involving the pelvis, spine, joints [19]. CT can quickly and safely diagnose injuries to the thorax with suspected intra-thoracic organ damage [10] and the role of CT of the chest is now recognised to aid in the diagnosis of rib fractures [1,40].

4.2.2. Magnetic resonance imaging (MRI)

Literature and guidelines regarding MRI’s role in imaging suspected SPA/NAI has deemed that MRI has a superior ability in defining the full extent of cranial injuries, being able to satisfactorily illustrate parenchymal injury in the acute phase and detecting haemorrhages, fluid accumulation, contusion areas, diffuse axonal injury and cerebral oedema [10,19]. The detection of such injuries requires tailoring of pulse sequences including T1-weighted, T2-weighted, FLAIR, T2-gradient echo and diffusion weighted sequences in a number of planes [3,10]. Eurfet et al. [10] suggest that MRI has the highest degree of sensitivity and specificity in the diagnosis of ‘child abuse’ hence the modality should always be a part of the imaging investigation process in cases of suspected SPA/NAI. The SCOR-RCR [40] guidelines recommend an MRI scan of the spine in children who have “ongoing abnormal neurological signs or symptoms.” Whilst patients with spinal injury also warrant CT or MRI investigation, MRI is the modality of choice to assess the spinal cord in the presence of neurological deficits [1,44], as it does not involve the high levels of radiation associated with CT scans. The RCPCH systematic review (2018) notes that whole-body MRI of fractures is not helpful as it is reported to have a low sensitivity (40%).

4.2.3. Nuclear medicine bone scintigraphy/scan

Bone scintigraphy may be utilised to assist in the investigation of suspected SPA/NAI cases because it is more sensitive than the skeletal survey in identifying occult rib fractures and is also sensitive for identifying long bone fractures [10,19,32]. Literature mentioning the use of bone scintigraphy in cases of suspected SPA/NAI has mostly regarded it’s use as being complimentary to the skeletal survey [5] with Kemp et al. [18] stating that neither modality alone can detect all fractures. RCH [35] includes ‘whole body bone scans’ in infants and children under the age of 3 years. In children above the age of 3, bone scintigraphy is performed if multi-site trauma is suspected, with radiographs acquired of any sites demonstrating increased uptake of radio-pharmaceutical (i.e. “hot spots”) on the nuclear medicine scan [35]. The use of bone scintigraphy scans in conjunction with the skeletal survey is supported by the RCPCH [37] as it may help identify new findings in 12% of cases. The ACR Appropriateness Criteria state that bone scintigraphy should not replace the skeletal survey [44] The SCOR-RCR [40] guidelines specifically state that “radiosotope bone imaging is not usually indicated,” as it involves a relatively high radiation dose and requires further imaging to confirm fractures. Phillips et al. [29] compared the radiation dose for a skeletal survey including 19 images at their institution (0.5 mSv) to a bone scan (2.4 mSv) demonstrating the difference in radiation dose.

Although guidelines, protocols and publications acknowledge that bone scintigraphy is complimentary in the diagnosis of SPA/NAI, there are limitations that exist:

- Since the epiphysial and metaphyseal areas of long bones are areas of high bone activity in growing infants and children, metaphyseal fractures would be difficult to detect [10,32].
- Skull fractures are also not detectable on bone scans as they heal without periosteal reaction [32].
- Infections and malignancies return positive results on bone scan, which results with the specificity of bone scintigraphy being lower than radiographs [19].

Due to the limitations of bone scintigraphy, countries such as Germany had ceased its use in cases of suspected child abuse [10] with Sprigg [32] recommending that it only be used in selected circumstances. The general consensus now appears to be that bone scintigraphy is no longer recommended [29,40].

4.2.4. Ultrasound/Sonography

The SCOR-RCR [40] guidelines mention the use of ultrasound in detecting sub-periosteal haemorrhage in occult rib fractures and around fractures prior to any radiographically visible sub-periosteal new bone formation. Eurfet et al. [10] discussed the use of ultrasound in cases of blunt trauma to the abdomen preceding CT, where it is utilised to detect free abdominal fluid and injuries to abdominal organs and its use in follow up imaging for monitoring intracranial injuries via the open large fontanelle of infants. The use of ultrasound in bony investigation has some limited applications such as identifying metaphyseal fractures around the knee [37] but as it’s application is limited, it is not recommended as a primary tool in the investigation of bony injuries.

4.3. The role of the radiographer

As healthcare professionals, radiographers are required to maintain their professionalism at all the times, particularly during the imaging of suspected SPA/NAI. During the early stages, it should be noted by radiographers and all involved that SPA/NAI is still being investigated and has not yet been proven [7]. The medical imaging examination of suspected SPA/NAI is a time consuming process that may be distressing to those involved. The SOR [42] in the UK, as well as Phillips et al. [29] in New Zealand recommended that consideration and support be provided to the radiographers, nurses and the other healthcare staff involved in the radiological investigations of SPA/NAI.

A review of guidelines published by professional bodies regarding the role of radiographer and radiographic principles have highlighted the following:

- The primary role of the Radiographer is to produce high quality diagnostic images using appropriate and agreed protocols [14]. Hence they should have knowledge regarding which imaging modalities would best answer the legal question and undertake regular continuing professional development in the area of forensic imaging, keeping up to date with best current practice and guidelines [15]. The examining radiographer should also understand that they may be required to provide legal statements and that they themselves are responsible for producing the medical imaging evidence [15].
- Appropriate training in paediatric radiography techniques should be undertaken by radiographers who are involved in imaging of SPA/NAI [40]. As requests related to SPA/NAI may not always specify SPA/NAI on the request, radiographers need to be vigilant and insightful in identifying such requests [35]. Some articles/guidelines recommend that suspected SPA/NAI imaging examinations should only occur when radiographers with paediatric experience are available [32,40].
- The examination can be distressing to the patient and their parents/carers [42]. An appropriate explanation of the examination should be provided to the patient and their accompanying carer including the number of projections, duration of the examination and whether any immobilisation of the child may be required [14].
- The radiographer is responsible for ensuring radiation safety is maintained at all times, especially if parents or carers are present and involved in the examination [15]. The use of ionising radiation should be optimised in accordance with the ALARA principle [14] and protective lead shielding provided to those assisting with patient immobilisation, as well as applied to patients in situations where it would not obscure the region of interest.
- It is important from an image quality perspective that the patient keeps still and remains in the correct position during imaging. Whilst carers or parents may not be perceived as ideal in cases of suspected SPA/NAI, if their presence is deemed appropriate, they...
should be given a clear and concise explanation of the task so they can comply with the instructions of the radiographer [29]. Additional support in immobilising the patient should ideally be provided by staff who have previous experience such as a nurse or other member of the clinical team.

- The SCOR-RCR [40] guidelines state that two radiographers “with documented education and training in imaging of suspected physical abuse and forensic radiography techniques” should work together when performing a skeletal survey. It is also recommended that an appropriate health care professional who can assist in the immobilisation of the child as directed by the radiographers should be present [40].

- In ensuring images acquired are of the highest possible quality, skeletal surveys should be performed using the proper technical factors, accurate positioning and appropriate immobilisation techniques with the exposure factors tailored according to the patient’s age and weight [40].

- The patient should be clearly identified using a minimum of three forms of patient identification by the accompanying medical team member (e.g. nurse) and by both radiographers using the hospital identification bracelet [40].

- Radiographs should always include patients name, lead side markers [35] and the date and time of the examination. In order to meet evidential standards for continuity of evidence and to ensure that the images are accepted in a court of law, none of these factors should be added at a later date [39]. If the radiologist decides not to repeat imaging due to the absence of lead side markers and digital annotation is applied, this must be documented appropriately [40]. A record must also be kept of the radiographer(s) responsible for performing the imaging examination [40].

5. Conclusion

Suspected Physical Abuse/Non-Accidental Injury is an ongoing issue that affects children globally. In order to ensure that SPA/NAI is diagnosed as early as possible, medical imaging is utilised to provide evidence for such investigations. Although it has been noted in previous research that inconsistencies are present in the imaging protocols of different imaging departments, some professional bodies over the last few years have come together and published guidelines that have been recognised both nationally and internationally. This is evident by the guidelines published by ACR-SPR and SCOR-RCR which have been adopted into practice in many countries. New Zealand has also made a similar approach in 2015 on establishing a standardised national protocol for the skeletal survey. Currently Australia is still lacking as there is no such a national protocol nor a decision to adopt published guidelines from another jurisdiction. Therefore, it is recommended that the professional body for radiographers in Australia either take a similar path to that of New Zealand in establishing a nationally recognised protocol or adopt an evidence based protocol that is already published.

Supplementary materials


References


