

Professional Article

FORENSIC RADIOGRAPHY AND NON ACCIDENTAL INJURIES IN CHILDREN

dr. Davis Mihaela,

michaela.davis@ucd.ie,

School of Medicine and Medical Science, University College Dublin, Belfield, Dublin 4

ABSTRACT

Aim: This paper explores the role of the diagnostic radiographer from a forensic perspective when imaging children with potential non accidental injuries. The notion of child abuse and non accidental injury specifically is outlined.

Methods: Literature and legislation is presented from both the UK and the Republic of Ireland which have different legal systems.

Results: Practical application is made when exploring the radiographers' role and examples of possible non accidental injury presentations are outlined as well as requirements of witness statements.

Conclusion: Any radiographic examination has the potential to become a forensic case, and as such the radiographer has the possibility of being placed right in the middle of a forensic case. The radiographer has a valuable piece of the child protection jigsaw and as such has vital information to contribute to the evidential chain.

Key words: non-accidental injury, children, radiographer

INTRODUCTION AND AIM

It is important to remember that every radiographic imaging examination undertaken could potentially be or become forensic in nature (IRRT, 2010).

Suspicion and Diagnosis of non accidental injury

Non Accidental falls within the umbrella term of child abuse. This latter term is a large area which includes emotional, physical, sexual abuse and child neglect. Often the abuse will involve two or more of the above. For example emotional abuse may accompany physical abuse or any of the above.

It is first necessary to define the term child abuse, this is: "An intentional act of commission or omission by another person that harms or threatens to harm a child in a significant way" (Department of Health (2001), Birchall and Hallett (1995), Irish Statute Book (1991)).

The key points to note from this definition are the following. The act is an intentional act committed that harms or threatens to harm the child. Alternatively it may be the omission of an act that harms or threatens to harm the child, for example this could be failure to protect a child from a dangerous situation, failure to provide food and water

for a child or similar (Barker and Hodes 2004). An equally important factor is that the above harms or threatens to harm the child in a significant way. The term 'significant' is open to professional interpretation and often is the basis of many a child protection discussion and a detailed exploration of the concept is beyond the scope of this paper. Readers are directed to Department of Health 1991, 1999, Irish Statute Book 1998, 2002.

The focus of this paper will be on Non Accidental injury herein referred to as NAI. Speight (1997) stresses the importance of the diagnosis of Non Accidental Injury – "Non accidental injury is one of the most important diagnoses in clinical paediatrics as it can so vitally influence a child's life. At worst it is a matter of life and death for the child and short of death there may still be possible brain damage or handicap" (Speight in Meadows, 1997).

NAI may come to the attention of the radiographer in a variety of ways. One way maybe where the radiographer is asked to conduct a skeletal survey to confirm suspicions of NAI (College of Radiographers 1995, College of Radiologists 2008). Alternatively it may well be an incidental finding on a radiographic image. For example a radiographer may be asked to conduct a chest radiographic examination for pyrexia of unknown origin, and therefore may give no suspicion of NAI. However on reviewing the image the radiographer may see posterior rib fractures, which would be a potential flag to alert the clinician and certainly warrant further investigation. Alternatively the radiographer may witness a particular event involving the child in the x-ray room or may be a disclosure by the child is made to them, (Davis, 2005).

Children may present at any time to an x-ray department and unless there is a dedicated paediatric hospital to which children are directed to, the local general hospital is often the first point of call following an injury, accidental or otherwise. Therefore any radiographer can potentially encounter a paediatric case, with some radiographers x-raying children on a regular basis (Davis, 2005; Davis and Reeves, 2004). However NAI is brought to the radiographers attention it is prudent to heed the words of Parton et al., 1997.

"Child abuse (and NAI) is identifiable, predictable and preventable via the development and application of scientific research. If only social workers and other professionals familiarised themselves with these research findings and integrated them into their everyday practice, tragedies could be avoided." said Parton et al., 1997.

THE RADIOGRAPHER'S ROLE

As with any radiographic examination, the role of the radiographer is to produce technically correct radiographic images using the lowest possible radiation dose consistent with good image quality (College of Radiographers, 1995; Hogg et al., 1999; Irish Statute Book, 2007; College of Radiologists, 2008; Moore et al., 2012). Previous research by Hogg et al., (1999) referred to the radiographer's role as going beyond the technical acquisition of the radiographic images and further research by Sudberry et al., (1997a, 1997b) referred to the social and emotional role of the radiographer when imaging a child with suspected NAI. This was later highlighted in the Victoria Climbié case (Conway, 2003). Along a similar vein, Davis, 2005 referred to the importance of the radiographer as an evidence collator in the x-ray room during such examinations, and although this was a study published in Ireland, there is similar literature in the UK published by the Department of Health, 1999 regarding protecting children. The principles are transferrable in that the radiographer may be the only person to witness an event, or receive a disclosure which no one else will know unless the radiographer passes that information on. In order to do this the radiographer working under their professional code of conduct (College of Radiographers, 1995; Irish Institute of Radiography and Radiation Therapy, 2010) must understand the significance of the information as discussed Rigney and Davis in their earlier paper of 2004. However Davis and Yelder, 2009 referred to the apathy of radiographers particularly in relation to child protection and suggested various reasons for this.

KEY POINTS IN FORENSIC IMAGING

As the radiographer is producing evidential documents in the form of radiographic images their role is important Sudberry et al., (1997b) highlight the importance of this. The images are also important from a diagnostic and potential treatment point of view and much work has been undertaken regarding potential fracture diagnosis of NAI (Carty, 1997; Royal College of Radiologists, 2008). The radiographic images are part of the forensic process and the chain of evidence (Davis and Reeves, 2009). The Evidential Chain must be maintained and must show continuity of evidence this will be explored in more detail.

The nature of the evidence may be in a variety of formats as outlined below. The evidence may be in the form of Images single or multiple for an unrelated matter, such as in the chest x-ray example above. Alternatively the evidence may be a skeletal survey, together with localised projections of specific areas. It may also be an event that was witnessed by the radiographer or a verbal disclosure. Whatever the nature of the evidence it is important that it is documented by the radiographer. Regarding the earlier point of Image production, it is important that this is conducted in front of a witness, such as Health or Social Care Professional. This witness can then provide a testimony as to what occurred in the x-ray room, this is particularly important regarding the number of projections taken, images produced, the placement of anatomical markers and any bruises or

marks that the child may have on their body prior to the radiographic examination.

EVIDENTIAL CHAIN

Throughout any potential or actual NAI case the evidential chain must be maintained. In reality for radiographers this means adherence to particular criteria. For example it is important that there is a record of the child being x-rayed and that the appropriate documentation is completed including witness statements. See Table 2 for an example witness statement. It is important that any notes are made contemporaneously so that a detailed record of all events is recorded and traceable. This forms part of the evidential chain.

It is a sobering thought to remember that any break in the evidential chain may cause the whole chain to collapse. The radiographer may inadvertently break or compromise the evidential chain by their actions or questioning of the child.

All radiographers undertaking forensic examinations should complete a Witness Statement as an accurate and complete record of their involvement in that forensic examination. Such a statement should encompass all aspects of an individual's involvement in a forensic case and should be based on contemporaneous notes (written as you progress through the examination). These detailed contemporaneous notes should be signed and dated and a record kept, as the originals will be given to the investigating officer or passed on at the time of the initial child protection referral. However as the radiographer is imaging the child for suspected NAI, it is important to revisit the indications of this clinical condition.

INDICATIONS OF NAI

Rigney and Davis, 2004 explored radiographers' ability in the Republic of Ireland to recognise NAI and reported that 90% of their sample size was able to detect rib fractures as a positive indicator of NAI. In a later bi cultural study focusing upon paediatric radiographers in Slovenia and the Republic of Ireland conducted by Moore, Davis and Starc, 2012, in which radiographers were presented with a series of radiographic images and asked to rate how confident that they were that the images demonstrated NAI or not, it was interesting to see the radiographers' ability to discern NAI from non NAI images. There are various factors that radiographers need to be aware of when imaging a child that can act as potential indicators of NAI. These are summarised in the table below.

Table 1: Factors to consider when imaging children

History of injury	Does it change over time? Is it credible? Is it vague?
Age of the child	Is the injury consistent with the age and ability of the child?
Demeanour of child	How does the child present? What is its general demeanour?
Interaction between child and parent	What is the interaction like between the parent and child? Is the parent aggressive to the child? Do they handle the child roughly?
Frozen awareness	Does the child exhibit frozen awareness?
Appearance of child	What is the appearance of the child? Do they appear unkempt?

after Rigney and Davis, (2004)

A babygram (the whole child on one image taken using one radiographic exposure) is not appropriate to use during the imaging process as it is undiagnostic (McKinstry, 2001). In cases such as these the radiologist is looking for subtle fracture such as Metaphyseal fractures and epiphyseal fractures including Bucket handle, corner and chip fractures. Consequently a babygram will not show these for a variety of reasons. Firstly the child's bones and joints are not in the correct anatomical position, so there is no true Antero Posterior or Lateral depiction of the joint spaces. Additionally these fractures may be very subtle and so require close scrutiny and occasionally localised projections. Furthermore the babygram gives a large radiation dose to the child and is not admissible as evidence in court. Other fractures which may occur on suspected NAI images are multiple or wide complex skull fractures, rib fractures and fractures in various stages of healing.

GUIDELINES

It is important that radiographers work within the appropriate legal and forensic guidelines according to their country. The Irish Institute of Radiography and Radiotherapy (ISRRT) guidelines are outlined below. If radiographers are unaware or unsure of the guidelines Davis and Reeves (2004) question how do they know they are working within them?

TECHNIQUE

Each anatomical area should be imaged with a separate radiographic exposure to ensure uniform image density and to minimize image unsharpness. This is in preference to the babygram referred to earlier. Additionally every radiographic exposure should demonstrate bony and soft tissue details simultaneously. Furthermore radiographic projections should be obtained at ninety degrees if an abnormality is suspected.

As referred to earlier the technical aspects are only one part of the examination and the radiographer should complete a witness statement. Such a statement may well reduce the likelihood of a court appearance by explaining the events in the x-ray room.

All Radiographers undertaking forensic examinations should complete a Witness Statement as an accurate and complete record of their involvement in that forensic examination. Such a statement should encompass all aspects of an individual's involvement in a forensic case and should be based on contemporaneous notes, written as the radiographer progresses through the examination. These detailed contemporaneous notes are important.

A witness statement should include the following points as outlined overleaf.

Table 2: Witness Statement

All radiographic (X-ray) imaging was performed using the xxxx Digital
Radiography unit in room xxx in xxx Hospital in the presence of witness xxx between 11.00-11.45am on day / month / year.
Others present and their role.
All exposures were made using a X-ray tube focus to detector distance of 100cm and exposure factors of xxx kVp and xxx mAs.
Right and left sided anatomical markers were placed within the collimated field at time of
exposure to allow sides to be identified for all exposures.
A total of x radiographic images were acquired:
List ,using correct terminology in order of actual acquisition
Preliminary Findings:
Name of Radiographer: Signed: Date:
Name of Appropriate Witness: Signed: Date:
xxx Number of images/CDs printed/burnt. These were presented to xxx who
signed to acknowledge receipt of them on day date/ month/year at time.
Name of Representative of Radiology Dept: Signed: Date:
Name of Person who received images/
CD: Signed:

REFERENCE ISRRT (2011)

Imaging Requirements are that each image must have the correct patient identification details, as well as the time and date of the examination inherent on the image. It is not acceptable to write the details on the image at a later date as this will not be admissible in Court as evidence. The name(s) of the Radiographers and the other attending professional must be recorded at the time, ideally upon the image. A single exposure "babygram" must not be performed as it provides sub – optimal image quality; is high radiation dose; and is diagnostically unacceptable to demonstrate anatomy and fractures; and also will not result in true antero-posterior

or lateral positioning (ISRRT, 2011). Several images may well be produced particularly if a full skeletal survey is requested. A typical skeletal survey image series is outlined over the page in Table 3.

Table 3: Standard skeletal survey

Skull <i>antero-posterior (AP) and lateral projections</i> <i>a Townes projection should be obtained for occipital injuries</i> <i>skull radiographs should be taken as part of the skeletal survey, even if a CT brain scan has or will be performed, as some skull fractures are not identifiable on CT</i>
Chest <i>AP including the clavicles</i>
Abdomen <i>AP of the abdomen to include the pelvis and hips</i>
Spine <i>lateral cervical spine.</i> <i>lateral thoracic spine.</i> <i>lateral lumbar spine.</i>
Limbs <i>AP of both humeri</i> <i>AP of both forearms</i> <i>AP of both femora</i> <i>AP of both tibias/fibulae</i> <i>dorsi-plantar (DP) of both hands</i> <i>DP of both feet</i>

Ref ISRRT (2011)

CONCLUSION

Any radiographic examination has the potential to become a forensic case, and as such the radiographer has the possibility of being placed right in the middle of a forensic case, and may be called to a Court of Law to explain their actions, input or what they witnessed during the radiographic examination. Consequently the radiographer provides a valuable role in forensic imaging and especially in relation to NAI. The radiographer has a valuable piece of the child protection jigsaw and as such has vital information to contribute to the evidential chain. It is important that the radiographer does not unwittingly break the evidential chain by their actions as the consequences for the child may be far reaching.

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