Review of the new RCR guidelines (2017): The radiological investigation of suspected physical abuse in children

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BACKGROUND

Every paediatrician at some point in their career will be involved in cases of physical abuse. The evidence base has highlighted that there is a significant rate of occult injury on skeletal imaging in cases of suspected physical abuse. There is a need to create consistency of practice to ensure that abuse is being correctly diagnosed and that there is governance around exposure to radiation. This article aims to summarise the latest Royal College of Radiology guidance published in September 2017.

INFORMATION ABOUT THE CURRENT GUIDELINE

In September 2017, the Royal College of Radiologists (RCR) and the Society and College of Radiographers published a revised guidance entitled 'The radiological investigation of suspected physical abuse in children'.[1] This is/has been endorsed by the Royal College of Paediatrics and Child Health (RCPCH). The document aims to support clinicians and health workers involved with the requesting, performing and/or reporting of imaging in children suffering suspected physical abuse.

PREVIOUS GUIDELINE

The new guideline supersedes the 2008 RCR and RCPCH collaborative 'Standards for radiological investigations of suspected non-accidental Injury',[2] which previously provided emergency, paediatric and imaging departments with a diagnostic framework. The older guidance included a system of red flags, escalation, recommended investigations and follow-up, which is partially retained in the updated document (box 1).

KEY ISSUES

- Which children should be imaged when physical abuse is suspected?[2]
- Which imaging modalities should be used to maximise detection of occult injuries, while limiting unnecessary radiation exposure?
- How should the imaging be performed, reported and communicated?
- When should initial and follow-up imaging be undertaken?

WHAT SHOULD I START DOING?

- Where a child is suspected of being a victim of physical abuse, the following relatives under 2 years of age should undergo a skeletal survey (±CT head if under 1), regardless of any findings on physical examination:
  - Any multiple birth sibling.
  - Siblings and children living in the same household or family.
  - The sibling recommendation is currently under review due to new evidence identified after the guideline was published (still under review by the RCR, 12 July 2018).
- Confirm that local departments have robust systems in place to ensure appropriate follow-up of radiological imaging. *This is an essential component to radiological investigation of suspected physical abuse. Remember a 'normal' first initial skeletal survey does not necessarily exclude fractures and physical abuse and therefore necessitates follow-up skeletal survey.*
- Provide information leaflets to parents regarding skeletal survey imaging. An example of this can be found in appendix B of the RCR guideline.[1]
- Always obtain *written* consent for radiological imaging from the person with parental responsibility, unless there are over-riding

Box 1 Resources

- The radiological investigation of suspected physical abuse in children. September 2017. https://www.rcr.ac.uk/publication/radiological-investigation-suspected-physical-abuse-children.[1]
- Standards for radiological investigations of suspected non-accidental injury. March 2008. https://www.rcpch.ac.uk/system/files/protected/news/StandardsforRadiologicalInvestigationsD[1].pdf.[2]

circumstances of clinical urgency. An example consent form can be found in appendix C of the RCR guideline.[1]

- Follow-up imaging should be performed within 11–14 days and *no later* than 28 days. It should be noted that repeat skeletal survey is not required in its entirety and should be balanced against radiation risk—most cases will require only repeat views of the chest and oblique ribs, plus any other areas showing fractures or possible fractures on the initial survey. This will help detect occult injuries, help to clarify any equivocal or suspicious findings, and may help with dating of the skeletal injuries.

WHAT CAN I CONTINUE TO DO AS BEFORE?

- Carry out a skeletal survey in all children under 2 years of age if physical abuse is suspected (box 2).
- The skeletal survey should be performed and reported within 24 hours of the imaging request and no later than 72 hours.
- All children under 1 must have a CT head if physical abuse is suspected.
- Children over 1 must have a CT head whenever signs of head trauma or abnormal neurological findings are present.
- Effectively and clearly communicate with the radiology team and the child's family.
- Ensure that the request for radiological imaging contains all relevant clinical information, the mode of presentation and, if appropriate, medical, family and/or social history.
- Where physical abuse is suspected, a *social care referral* must be made within the first 24 hours.

Children with abnormal findings on CT head should undergo a follow-up *MRI brain 2–5 days* following the insult (this recommendation remains unchanged from the RCR 2008 guideline[2]). An MRI of the spine should also be undertaken at the same time.

IMAGING MODALITIES

- Plain radiographs are the imaging modality of choice for identifying and characterising fractures in children.
- CT has demonstrated high sensitivity in diagnosing rib fractures; however, its use is not usually justified because of its substantially increased radiation dose. It could be considered as an adjunct in a complex situation and is the recommended acute imaging modality for the head.
- Ultrasound can be valuable for diagnosing subperiosteal fluid, metaphyseal and rib fractures but is not routinely used due to the availability of radiologist expertise.
- There is currently insufficient evidence to support the use of bone scans to identify fractures in suspected cases of physical abuse.
- Whole-body MRI has not yet demonstrated benefit as a routine investigation in suspected abusive trauma. However, MRI of the brain plays an important role in the characterisation of intracranial CT abnormalities and for prognostication. MRI represents the follow-up imaging modality of choice.

CRITICAL REVIEW AND UNRESOLVED CONTROVERSIES

- Much of the evidence base on physical abuse in children stems from retrospective studies, which often involve small sample sizes, making it difficult to make firm recommendations.
- It has been recognised that few institutions follow the RCR guidance especially regarding CT head in those under the age of 1. Further education is needed to re-educate risk versus benefit and latest dose exposure evidence as newer scanners have reduced radiation dose.
- The new RCR guidance mandates that two radiologists with at least 6 months of specialist training in paediatric radiology and experience of suspected physical abuse in children should provide a consensus report of the skeletal survey within 24 hours. Most smaller hospitals will lack the infrastructure to double-report skeletal surveys

Box 2 The standard child protection skeletal survey for suspected non-accidental injury[2 3]

Skull
- Anterior posterior (AP), lateral and Towne's view (latter if clinically indicated).
- X-rays of the skull (including lateral) should be taken with the skeletal survey even if a CT scan has been or will be performed.

Chest
- AP including the clavicles.
- Oblique views of both of the sides of the chest to show all the ribs (1–12)—'left and right oblique'.

Abdomen
- AP of the abdomen including the pelvis and hips.

Spine
- Lateral: this may require separate exposures of the cervical, thoracic and thoracolumbar regions.
- If the whole spine is not seen in the AP projection on the chest and abdominal radiographs, then additional views will be required.
- AP views of the cervical spine are rarely diagnostic at this age and should only be performed at the discretion of the radiologist.

Limbs
- AP of both upper arms.
- AP of both forearms.
- Coned elbow and wrist.
- AP of both femurs.
- AP of both lower legs.
- Coned lateral knee and ankle.
- Posterior anterior of the hands.
- Dorso plantar view of the feet.

Box 3 Additional useful resources—help to aid professionals when a skeletal survey may be indicated

- Development of guidelines for skeletal survey in young children with fractures. Joanne N Wood, Oludolapo Fakeye, Chris Feudtner, Valerie Mondestin, Russell Localio and David M Rubin. American Academy of Paediatrics, originally published online 16 June 2014. http://pediatrics.aappublications.org/content/pediatrics/early/2014/06/10/peds.2013-3242.full.pdf.[3]
- Guidelines for skeletal survey in young children with fractures. Borg K, Hodes D. *Arch Dis Child Educ Pract Ed* 2015;100:253–256.[4]

in such a tight timeframe. Adopting this particular recommendation into clinical practice could potentially lead to discharge delays, especially if a second opinion is obtained from another hospital institution. A potential solution to this issue could be the development of paediatric reporting 'networks', which may help meet the consensus standard.

- There are small studies in which siblings under 2 years of the index child have also had fractures found on skeletal survey. However, is this evidence enough that all siblings under the age of 2 years be subjected to a skeletal survey as the new guideline suggests? As of July 2017, the RCR website states that it is consulting on revisions being proposed on four of the recommendations in light of new evidence brought to the attention of the working party.
- The RCR guideline does not provide guidance on which fractures suggest physical abuse and therefore necessitates a skeletal survey in children under 2 years. Wood *et al*[3] have developed a set of criteria which addresses this (box 3). Borg and Hodes'[4] critical review of the Wood *et al* guideline[3] may further act as an adjunct to this guideline to aid decision making when performing a skeletal survey.

HOW DO I IMPLEMENT THESE GUIDELINES INTO MY PRACTICE?

- Discuss with your local radiology team and find out their ability to provide a service for radiological imaging in cases where child physical abuse is suspected, according to the standards set out by the RCR guideline.
- Consider joint training between paediatric and radiology teams to update all team members on the latest guidance.
- Ensure that comprehensive and up-to-date parent information leaflets and consent forms are easily accessible in your clinical areas.

FICTIONAL CASE

Freddie is a 10-month-old boy who presents to the paediatric accident and emergency department with his mother who has noticed he is not using his right arm. He is the first child of parents who have recently separated but share childcare. Freddie is not yet walking but has started cruising. On examination, he cries when his right wrist is examined but has no obvious swelling to the wrist or elbow. He has two small bruises to his left shin. He is not on a child protection plan. Plain X-ray of the wrist shows a metaphyseal fracture of the distal radius. His mother reports that he has not had any injuries in her care, but she would have to check with his maternal grandmother and father who have both looked after him in the last week.

Take home messages

- All children under 2 years where physical abuse is suspected MUST have a skeletal survey.
- All children under 1 year should also have a CT of the head even if there are no neurological signs or head injury suspected.
- Obtain written consent from the individual with parental responsibility and provide an information leaflet.
- Ensure that a focused follow-up skeletal survey is undertaken—ideally 10–14 days from the initial survey.
- Multiple birth or other siblings of the index child who are under 2 should have a skeletal survey (±CT head if under 1)—please be aware this is currently under review by the RCR.

Discussion

- Key concerns for physical abuse:
  - Unexplained mechanism.
  - Metaphyseal fracture of the distal radius.
- Pathway from the RCR guideline undertaken after initial imaging was performed and immediate management for fracture was undertaken:
  - Request for skeletal survey and CT of the head as child under 1.
  - Written consent for skeletal survey obtained from the mother. Information leaflet also given.
  - Repeat limited skeletal survey arranged for 10–14 days after initial survey.
  - Referral to social care within 24 hours.

Management

- Reviewed by orthopaedic team and a below-elbow cast applied with follow-up.
- Admitted to ward due to child protection concerns.
- Body map of any injuries documented within 24 hours.
- Referral to social care made within 24 hours of presentation.
- Skeletal survey undertaken the next day as no mechanism known and age <2 years.
- CT head requested as child under 1 year of age.
- Skeletal survey did not reveal any other fractures or bony injury. Ophthalmology review was also done and was normal.
- Strategy meeting held with police and social care for further investigation of how the injury could have occurred.
- Discharge planning meeting occurred prior to discharge (as per local hospital guidance).

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