

SKELETAL SURVEY FOR SUSPECTED NON ACCIDENTAL INJURY (NAI)

Skeletal Surveys are undertaken

- Only at the request of a Consultant Paediatrician.
- As a planned event.
- A computer request form is required to book the examination in the main X-Ray Department.
(These examinations are never carried out in the A&E Department).
- A computer request form does not allow for a signature. Radiography for NAI will not be carried out unless a standard hospital consent form (ochre/white) with a Consultant Paediatrician's signature accompanies the patient.
- A registered pediatric nurse or a registered health or care practitioner, preferably a nurse who has worked with the child on the ward, must accompany the patient (assistant healthcare / practitioners do not meet the criteria). The immobilisation required for young children can appear extreme to the untrained eye and it is important that there is an independent witness to the examination. They also provide re-assurance for the child independently of the radiographers involved with the imaging. Sedation may be required.
- Parents and carers must be fully informed of the implications of the examination and be given an opportunity to discuss and ask questions about the situation before they arrive in the X-Ray Department..

Parents and carers may accompany the child but there is a limit to the number of individuals who can be present in the X-ray room and IRMER regulations apply. The radiographer has the right to exclude individuals from the room.

Radiographic Requirements.

Parents/carers should not be asked to hold the baby still for the radiographic exposures. Because of their emotional involvement with the child it is unlikely that they will be able to position and immobilize the baby satisfactorily and should not be asked to do so.

- 2 qualified radiographers should work together, one of whom must be a Superintendent. If no Superintendent is available a Senior 1 should take charge of the examination.
- The examinations are never performed outside of normal working hours.
- Images must be of the highest quality with careful attention to side marking.
- Correct and visible patient identification is essential.
- Both radiographers must annotate each image saved to PACS with their initials.
- **Both radiographers must sign the paper request form to confirm that all images have been saved to PACS and scan the signed request form as a permanent record that this has taken place.**

It is essential that this is carried out since the records may be required in future for court proceedings

The Minimum Projections Required for a Skeletal Survey are as follows:

Head, chest, spine and pelvis:

- AP and lateral skull.
- AP chest (to include shoulders)
- Oblique views of ribs both sides (to include all ribs, 1-12)
- AP abdomen and pelvis
- Lateral whole spine (on one view is possible. For larger children separate views will be required)

Upper limbs:

- AP of the whole arm (centred at the elbow)
- Coned lateral elbow
- Coned lateral wrist
- PA hand and wrist

In larger children where a single whole arm view is not possible

- AP humerus (including the shoulder and elbow)
- AP forearm (including the elbow and wrist)
- Coned lateral elbow
- Coned lateral wrist
- DP hand and wrist

Lower limbs:

- Whole AP lower limb, hip to ankle
- Coned lateral knee and ankle
- Coned AP ankle (mortise view)
- DP foot

For larger children

- AP femur
- AP tibia and fibula
- AP knee
- AP ankle
- Coned lateral knee
- Coned lateral ankle
- DP foot

The Radiologist may request supplementary views, including coned views of the metaphyses and lateral views of any suspected fracture.

SERIES ORDER ON PACS.

- Skull AP and lateral.
- AP chest
- Oblique ribs R and L
- AP abdomen and pelvis
- Lateral whole spine
- R arm including coned lateral views
- L arm including coned lateral views
- Both hands
- R leg including coned lateral views and additional views in larger children
- L leg including coned lateral views and additional views in larger children
- Both feet

CT Head Imaging:

Brain CT should be carried out **for all children under the age of 1 year in whom NAI is suspected.**

Babies of this age should be scanned using the 'feed and wrap' procedure and do not require sedation.

When the examination is completed, images should be shown to a Consultant Radiologist (preferably Dr Niewiarowski or Dr C Ashwin). If not available the images should be shown to the Consultant Radiologist covering hot seat.

If this is not possible at the time of the examination, the child should be returned to the ward but may have to come back for subsequent projections.

MRI Head and spine imaging:

MRI of the head and spine should be performed at day 2-5 for all children when CT has demonstrated intracranial haemorrhage and/or parenchymal brain injury and /or skull fracture. MRI head and whole spine should also be performed for children in who there are ongoing abnormal neurological symptoms or signs irrespective of an apparently normal CT.

Follow up imaging with CXR:

Follow-up imaging 14 days after the initial skeletal survey. Even if the initial skeletal survey is normal all children should have follow-up imaging to identify fractures which only become visible with healing.

Follow-up radiographs should be performed of any abnormal or suspicious areas on the initial skeletal survey plus the following views:

- Chest AP (to include shoulders)
- Oblique ribs (left and right to include all ribs)
- AP whole arm (centred at the elbow). In larger children, AP humerus and AP forearm separately to include both joints.
- AP whole lower limb. For larger children AP femur and AP tibia and fibula separately to include both joints.

An appointment will be booked at the time of the initial skeletal survey for follow-up imaging. The ' Code 5 Co-ordinator ' in Radiology will alert the clinician if the patient fails to attend.

Radiation Safety and Risk

All radiation exposure carries a risk of inducing cancer.

Due to associated uncertainties it is generally considered inappropriate to quantify the risk from a diagnostic X-ray exposure on an individual basis. However, based on typical risk factors published by the UK's former Health Protection Agency (HPA) the range of total lifetime cancer risks in terms of effective doses arising from diagnostic X-ray examinations can be expressed for specific groups (of both genders and of a specific age range).

A skeletal survey, which involves several X-ray exposures equates to approximately 3 weeks of natural background radiation in a child under the age of 1, 4 weeks for a 1-2 year old and 5 weeks in a child of 5 years of age. (For comparison a chest X-ray represents an exposure equivalent to 3 days).

Based on exposure factors used at this Trust the calculated risk of developing cancer from a skeletal survey is very low (1 in 10,000 to 1 in 100,000).

A CT brain scan involves a higher radiation dose and is equivalent to 1 -4.4 years of background radiation in a newborn infant, 1-2 years in a 5 month old and 1 year in an 11 month old.

For the general population the following risks apply

Risk of fatal cancer in childhood 1: 500

Risk of fatal cancer during any
person's whole lifetime 1:3

Risk of developing cancer from a
skeletal survey 1:10000 – 1:100000 (very low)

The average risk of developing cancer from a CT Brain scan (male:female)

- newborn 1: 1000 – 1:1200 (low)
- 5 month old 1:1200 – 1:1700 (low)
- 11 month old 1:2500 – 1:3400 (low)

To put this into perspective below is a table comparing the different levels of risk of cancer from radiation to the probability of developing cancer in the general population

Risk qualification	Approx level of additional risk of cancer incidence	Probability of developing cancer in the general population (% LBR)	Probability of developing cancer in the general population if adding this extra level of risk (% LBR + % LAR)
Negligible	<1 in 500 000	42	42.00
Minimal	Between 1 in 500 000 and 1 in 50 000	42	42.00
Very low	Between 1 in 50 000 and 1 in 5 000	42	42.02
Low	Between 1 in 5000 and 1 in 500	42	42.25
Moderate	Between 1 in 500 and 1 in 250	42	42.50

Communicating Radiation Risks in Paediatric Imaging; WHO (LBR - Lifetime baseline risk, LAR - lifetime attributable risk)

Although the CT brain scan represents a very small increased risk, it is important that this risk is balanced against the clinical indication for imaging. Where the safety of the child is at risk, the potential benefits of establishing a diagnosis will outweigh the excess risk attributable to the radiation.

All X Ray procedures carried out at Ashford and St Peter's Trust conform to the strict guidelines laid down by the legislative framework of IR(ME)R 2000 For the use of ionising radiation in diagnosis.

Reporting of Skeletal Surveys

A report by a Consultant Radiologist will be available on PACS within 24 hours of the examination being carried out.

A second report will be issued by one of the Paediatric Radiologists (Dr Niewiarowski or Dr Ashwin) as soon as possible after this. This allows for the images to have been reviewed by at least 2 separate Radiologists and will improve diagnostic accuracy.

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Consultant Paediatric Radiologist
Dr Clare Hill,
Consultant Pediatrician (Named Consultant for Safeguarding)

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