

Cork University
Hospital

Emergency
Department

Radiography
Protocols

May 2005

Updated July 2007

Updated Aug 2014

Amended Oct 2015

Amended Jul 2016

Amended Dec 2016 - Paediatric protocol removed and new paediatric protocol published as a separate document

LOWER LIMB

Toes

1. DP
2. DP Oblique

Big Toe (hallux)

1. DP
2. Lateral

Foot

1. DP
2. DP Oblique
in cases of a suspected - or seen - Lisfranc injury
3. Lateral
in cases of suspected but **not** seen Lisfranc injury
4. DP of both feet weight bearing. Injured side only will suffice if this is too difficult but both is ideal (see email from Dr Marshall in appendices at back of this folder)

Ankle

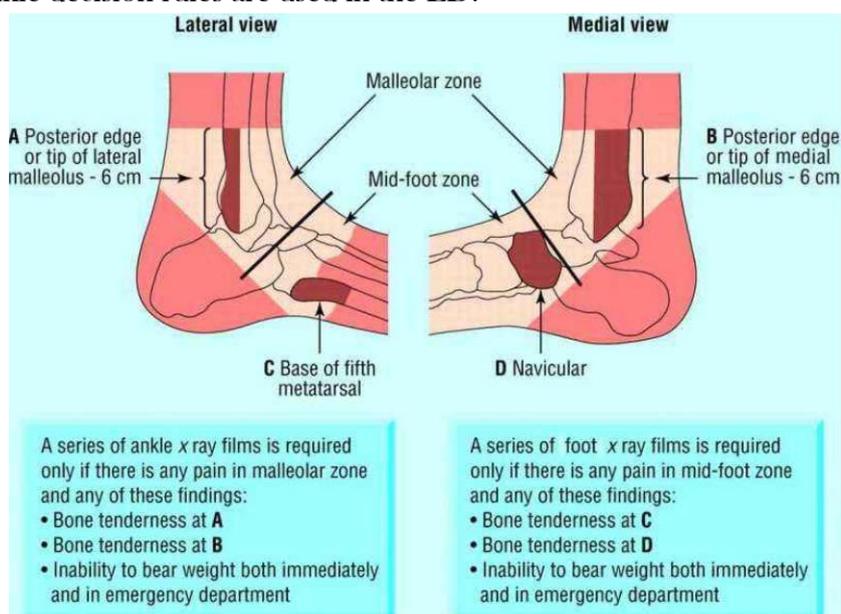
1. Mortice
2. Lateral
3. Straight AP (to evaluate syndesmosis for a “high ankle sprain” and also talar dome)

Requests for tib/fib & ankle must have separate ankle views centred over the joint space.

Foot & Ankle

Should not be ordered routinely but may be necessary in a small number of cases.

Ottawa ankle decision rules are used in the ED.



Calcaneum

1. Axial
2. Lateral

Tibia & Fibula

1. AP
2. Lateral full length. Include both joints.

* Requests for tib/fib & ankle must have separate ankle views centred over the joint space.

* Fractures of the ankle involving the joint space must have tib/fib full length views, to show knee & ankle joints together, if the equipment permits (this is not always possible on the ED equipment due to restriction of ceiling height).

* A mid-shaft fracture of the shaft of *any long bone* needs a routine follow-on of a full length image with both joints on, if not done already.

Knee

1. AP
2. Horizontal Beam Lateral.

* **HBL knee is mandatory at any stage post injury, regardless of the date of the injury.**
For all non-trauma presentations either turned lateral or HBL may be used.

Patella

1. PA if possible, AP if not,
2. Horizontal Beam Lateral.

* Modified 20° skyline may be possible if patient is holding knee in a partially bent position.

* Regular skyline views are rarely indicated. If requested do only after the referring doctor or a radiologist has seen the AP & Lateral

Femur

1. AP - both joints on one film if possible.
2. Lateral from knee up. Lateral NOF view only if it is indicated by clinical data.

* A mid-shaft fracture of the shaft of *any long bone* needs a routine follow-on of a full length image with both joints on, if not done already.

Hips & Pelvis

1. AP.

* For those with #NOF include 15cms of femur below the lesser trochanter for surgical planning.

2. HBL NOF must be horizontal beam for ?#

Prostheses

Patients with prosthesis **do not need** a lateral NOF view. They *may* need a full length femur as #s below the tip of the prosthesis are likely after trauma.

DHS

Patients with hip pinnings **need** a lateral NOF.

3. DISLOCATED HIP PROSTHESIS

- AP Pelvis
- AP Acetabulum (JUDET) centred over the affected side, collimated to that side only. Raise the *affected side* only. No need for the other judet.
This shows the exact position of the dislocated prosthesis in relation to the acetabular component of the prosthesis and also shows the position of the acetabular component.

UPPER LIMB

Fingers

1. PA, include the finger next to the injured one.
2. Lateral

Hand

1. PA
2. PA oblique
3. Lateral - only if requested by senior medical staff.

Thumb

1. AP
2. Lateral
 - If erect positioning is used, mark it as such.
 - Include scaphoid on thumb views

Wrist

1. PA
2. Lateral
3. Obliques - where the ED doctor requests them due to the results of clinical examination
4. Where they are not requested, have a low tolerance for adding obliques, especially where the injury was caused by a big animal, cow, bull, horse etc. or some other major force such as a kick-back from a machine

Scaphoid

(At 1st presentation and follow up)

Full series

1. PA with ulnar deviation and clenched fist
 2. Anterior oblique with ulnar deviation
 3. Lateral wrist
 4. Posterior oblique
 5. Elongated scaphoid, 30° cranial angulation
- * Include the whole wrist on every view. Never collimate tightly around the scaphoid.

Forearm

1. AP include both joints
2. Lateral

* A mid-shaft fracture of the shaft of *any long bone* needs a routine follow-on of a full length image with both joints on, if not done already.

* All requests for forearm & elbow must have separate elbow views.

Elbow

1. AP
2. Lateral

Radial Head

Full 360° rotation of the radial head is achieved by the following 4 positions:

1. AP elbow
2. True lateral thumb up
3. " " palm down
4. " " thumb down

Radial head views are almost never needed

Humerus

include both joints

1. AP
2. Lateral

*A mid-shaft fracture of the shaft of *any long bone* needs a routine follow-on of a full length image with both joints on, if not done already.

SHOULDER PROTOCOL

For patients who present with:

GENERAL SHOULDER TRAUMA - no specific clinical diagnosis

or

DISLOCATION - ? possible or definite

3 VIEWS

1. **AP** - straight - no rotation of the patient
2. Some form of **AXIAL**, either a FULL axial or a HALF axial
3. **Y-VIEW**

All 3 of these views have to be done even if the ED doctor is happy with just an AP

RELOCATION

Full axial will not be possible so it's

1. **AP**
2. **HALF AXIAL**

If the ED doctor has doubts about the complete relocation or if the orthopaedics request it, then also do a

3. **Y-VIEW**

N.B. As much as possible: Rotate patient to the affected side for gleno-humeral joint during HALF AXIAL view.

OTHER PRESENTATIONS FOR SHOULDER X-RAY

Clavicle

1. PA or AP no rotation of the patient - include whole shoulder area
2. AP with cranial angulation or PA with caudal angulation

For #s or ?# of the **medial end** of the clavicle

CT is the modality of choice

It may not be possible to clear the medial end of the clavicle from the lungs but it is very important. *If you have to x-ray it one* of these views may achieve it:

- **APICAL VIEW OF LUNGS** (patient PA and leaning back with apices distant from detector, horz beam)
- **Kitty Clarke angled clavicle with CR cassette** (patient supine on table, shoulders raised 15 degrees, cassette behind shoulder at 45 degrees, tube angled cranially at 30 degrees)
- **SERENDIPITY VIEW** (patient supine, tube angled 40 deg cranial)

Greater tuberosity

1. AP - hand in AP position, palm out
2. AP with internal rotation of the hand
3. Lateral head of humerus, PA

Acromio-clavicular joints

1. AP of shoulder generally suffices.

Scapula

1. AP shoulder
2. Lateral scapula Y - view

JULY 2014

THORAX

CXR protocol re: PA & Lateral

Amended: August 2014

ADULTS

1. PA only

in the majority of cases

LATERAL needed where:

- No previous CXR for this patient visible on our PACS system (from this or any hospital in the CUH group). *This is regardless of clinical presentation.*

- PA shows
 - New lung mass
 - or
 - New lung collapse

No laterals needed for second or subsequent CXR where the patient has

- Consolidation
- Pneumothorax

Never do a lateral on

- Pregnant patients
- or*

CHILDREN UNDER 16YRS

No laterals to be done on anyone under 16.

If requested by ED doctors check first with Radiologists

Specific presentations

Trauma CXR

Low kV CXR

for demonstration of pneumo/haemothorax, rib, clavicular and scapular fractures, mediastinal widening/shift, aorta, fluid, lung contusion.

Pneumothorax

1. Low kV CXR - No grid

INSPIRATION only

Cardiology patients and others with no history of trauma

1. High kV (80-110kV) CXR - PA as much as possible

See new CXR protocol re: laterals (Aug 2014)

Pre-op CXR

Not done routinely. All CXR requests must have clinical data with medical justification for the examination. (SI 478/2002 & CUH Anaesthetic department)

Ribs

Specialised rib views not done.

1. Low kV CXR only, as specified above.

Sternum

1. Lateral with grid.
2. CXR for demonstration of possible spinal, aortic and thoracic injuries following trauma.
Suspect the need for lateral sternum in RTA patients where the CXR shows clavicle # and contra-lateral lower rib #s (seat belt injury)

Inhaled Foreign Body

1. PA or AP CXR.
2. Lateral
 - Include neck on paediatric CXR

Patients referred from Eye Casualty

1. PA CXR for sarcoidosis.
The clinical data will indicate a finding of **uveitis**. These patients may also need radiography of the lumbar spine or SI joints for **ankylosing spondylitis**

ABDOMEN

Trauma

e.g. stab wound or kick

1. PFA supine (may be KUB)

GI Tract

The indications for PFA with a GI presentation are

- a) ? Obstruction
- b) ? Toxic mega-colon/ulcerative colitis
- c) ? Position of dangerous (sharp, toxic, or large in relation to anatomy) foreign body

1. AP Supine

Erect CXR may also be requested if perforation is also suspected

Renal system

CT should be first investigation

Occasionally:

1. PFA supine

And only after CT Renal Colic to see if stone can be followed by PFA

Ingested Foreign body

Small round foreign bodies e.g. coins do not need to be located by x-ray.

*Small means small enough to pass through all internal sphincters without effort. Coin size, child size and length of time since swallowed without passing the FB, will dictate the need for PFA

EXCEPTION: anything toxic such as batteries, which could leak. See section: Foreign bodies all areas

ERECT PFA IS NEVER INDICATED.

and should not be done for convenience

Supine PFA and Erect CXR will give more information.

MULTIPLE TRAUMA

Resus Series

1. CXR – Low kV (65-75kV)

to show free fluid, widened mediastinum, pneumo/haemothorax & # ribs

Low kV will show all of this well

Do not use >75kV with the CR system

2. Pelvis

For assessing pelvic ring integrity. Must be good quality. Use a grid. Include the sacrum and transverse processes of L5 as well as pubic rami.

Repeat if sacrum is not seen.

Do not repeat (in resus) for hips.

External fixator may be in place. X-ray through it.

3. Lateral Cervical Spine

Do last. C spine immobilisation can be maintained until the spine can be cleared.

Departmental Series

Will change according to the injuries but for all high-energy trauma expect requests for some or all of these:

Cervical /Thoracic /Lumbar spine;

Shoulders / Extremities;

Calcaneum (in falls greater than 4m)

Prioritise demonstration of serious/life-threatening injuries in case patient becomes unstable and imaging is cancelled.

* If no resus series was done

start with the resus series in the x-ray room

1. CXR and Pelvis.

then do

2. lateral c spine
3. all other lateral spine views
4. AP spine views
5. all other views

If resus series was done

this is the order of imaging:

1. lateral spine views
2. AP spine views
3. all other views

For spine and pelvis protocols see Section: Spine & Pelvis

Vacuum immobiliser mattress

gives serious artefact and increases the radiation dose. It must be softened for lateral spine views.

Sandbags

give serious artefact. They must be removed for lateral c spine views

The order of imaging in multi-trauma patients is extremely important and must be followed despite equipment design.

SPINE & PELVIS

Cervical Spine

1. Lateral
must include occiput to T1, soft tissues anteriorly and whole spinous processes posteriorly.
2. AP
3. Open mouth

C7/T1

1. Coned True Lateral (CTL) with tube at 135cm and collimation of 15 x 15
- for those whose lateral had 6 or more vertebrae visible.

Must include whole of spinous processes for identification of levels and repeat for these if necessary.

Very low dose.

2. Swimmers - where CTL is unsuitable or did not work.

Flexion and extension views are never done but may occasionally be requested by ED Consultant. MRI is the modality of choice for ligamentous injury

Thoracic Spine

1. AP
2. Horizontal beam lateral with a **1 second exposure on digital** (get patient to whistle or blow out through pursed lips) or a longer exposure time (**up to 6secs**) with normal breathing **on CR.**

This is extremely important:

The **AEC** must **NEVER** be used for lateral thoracic spines. It fails to demonstrate fractures of the posterior elements and could be responsible for delayed diagnosis of serious posterior column fractures.

Lumbar Spine

1. AP
2. Horizontal beam lateral.
 - Patients from eye casualty may need lumbar spine or SIJ radiography for ? **ankylosing spondylitis** in cases of **uveitis**

Hips & Pelvis

1. AP.
 - * For those with #NOF include 15cms of femur below the lesser trochanter for surgical planning.
2. Lateral NOF

? #

must be horizontal beam

Prostheses

Patients with prosthesis do not need a lateral NOF view. They may need a full length femur as #s below the tip of the prosthesis are likely after trauma.

DHS

Patients with hip pinnings do need a lateral NOF.

Dislocated Prosthesis

As well as an AP pelvis, patients with prosthetic dislocations need an AP acetabulum view of the affected side only, to show displacement in all four planes, superior, inferior, anterior and posterior. *Raise the affected side 45°, centre over the affected hip and collimate around that hip only. No need for any other view.*

A raised leg lateral is not needed. The AP acetabulum can be done easily on the trolley and is comfortable for the patient as it takes the weight off the dislocated side.

Inlet/Outlet views

Only when requested by the orthopaedic team. Rarely indicated in the ED. If done, try 30 - 35 degrees cranial and 20 degrees caudal.

Judet Views

Only when requested by the orthopaedic team. CT is the investigation of choice for a complex pelvic fracture. Rarely indicated in the ED but may be requested by orthos prior to transfer to Tallaght.

Sacro-Iliac Joints

1. PA angled down 15 -25 degrees

Or

2. AP angled up 15 -25 degrees

* Patients from eye casualty may need lumbar spine or SIJ radiography for ?
ankylosing spondylitis in cases of **uveitis**

Coccyx

Not indicated. Normal appearances are often misleading and findings do not alter management.

FOREIGN BODY – ALL AREAS

1. AP/PA
2. Lateral
for localisation

plus

3. Tangential for FBs in face and head area

Orbits ?FB

1. *Undertilted OM with Eyes UP*
but if FB seen also do:
2. *Undertilted OM with Eyes DOWN*

Inhaled Foreign Body

1. PA or AP CXR.
2. Lateral CXR
*Include neck on paediatric CXR

Ingested Foreign body

Small round foreign bodies e.g. coins do not need to be located by x-ray unless inhalation is suspected.

*Small means small enough to pass through all internal sphincters without effort. Coin size, child size and length of time since swallowed without passing the FB, will dictate the need for PFA

EXCEPTION: Always x-ray for anything toxic such as batteries, which could leak, or sharp objects which could cause perforation. If indicated do;

Adults

1. Lateral CXR only; include neck
2. PFA if indicated

Children

1. PA (or AP) CXR; include neck
2. PFA if indicated

Sharp objects may have to be followed up by x-ray over a period of time.

3. PFA may be indicated also in this case

Fish Bone

- Visible on x-ray - Cod, Haddock, Colefish, Lemon sole, Gurnard.
- More difficult to see - Grey mullet, Plaice, Monkfish, Red snapper
- Not visible on x-ray - Herring, Kipper, Salmon, Mackerel, Trout, Pike

SKULL & FACIAL BONES

Skull

CT brain is the imaging of choice in head injury

Indications for SXR in adult

Penetrating trauma

Indications for SXR in child

Penetrating trauma

Head injury with suspected NAI

Skull Views

1. AP
2. Lateral
3. Townes if suspected occipital injury.

Facial Bones

Erect only and post c-spine clearance in multi-trauma patients

1. OM
2. OM 30

Sinuses

Never x-rayed.

CT is the modality of choice for Sinuses

Orbits

?#

Undertilted OM

?FB

3. Undertilted OM with Eyes UP

but if FB seen also do:

4. Undertilted OM with Eyes DOWN

Mandible

1. OPG and PA mandible if ?#
2. If OPG machine is unavailable a full mandibular series is necessary.
 1. PA mandible
 2. Lateral mandible
 3. Oblique mandible - both side obliques

TMJs

Clinical diagnosis. X-ray not necessary in ED.

MRI is the modality of choice

OPG and PA Mandible for ? dislocation only

Nasal Bones

Not indicated in the ED. (Maxillo-facial follow-up).

PAEDIATRICS

New paed protocol is a separate document