Justification Criteria & Technique Guide for Plain Radiological Examinations

Document Control:

For Use In:	Plain Radiography Department, Radiology		
	Norfolk and Norwich University Hospital Trust		
Search Keywords	criteria, imaging, justification, plain, radiography, RADIOLOGY		
Document Author:	Plain Radiography Lead		
Document Owner:	Radiology		
Approved By:	Radiology Clinical Governance Committee		
Approved By:	Radiation Protection Service		
Ratified By:	Clinical Effectiveness and Safety Board		
Approval Date:	02/2024	**Date to be reviewed by:** This document remains current after this date but will be under review	02/2027
Implementation Date:			
Reference Number:	9347		

Version History:

Version	Date	Author	Reason/Change
V6.0	12/2020	Plain Radiography Lead	Changes to reflect iRefer guidelines and MRI/US MSK GP referral criteria for GP referred spines; patency capsule pathway updated; patellae added to trauma knee series; MCA form details added; addition of adult shunt series requirements; spinal projections updated for GP-referred radiographs
V7.0	06/2022	Senior Radiographer	Changes to notes for ortho pelvis, shapes studies, anatomical tilt wrists, lumbar and thoracic spine notes and justification criteria for leg lengths.
V8.0	02/2024	Plain Radiography Lead	Reviewed in line with new template. Removal of Appendix 8 - Scoliosis

			examinations requested by GPs should be a) **For Adults:** vetted with examination changed to lumbar spine and/or thoracic spine (determine site of deformity/pain); or b) **For paediatrics:** cancelled (send ICEmail to GP referrer instructing them to refer patient to appropriate Paediatric Orthopaedic Consultant).

Previous Titles for this Document:

Previous Title/Amalgamated Titles	Date Revised
None	Not applicable

Distribution Control

Printed copies of this document should be considered out of date. The most up to date version is available from the Trust Intranet.

Consultation

The following were consulted during the development of this document:

Chief of Imaging
General Radiography Consultant Radiologist Lead
Practice Development and Governance Manager
General Radiography and Reporting Radiographer Lead

Monitoring and Review of Procedural Document

The document owner is responsible for monitoring and reviewing the effectiveness of this Procedural Document. This review is continuous however as a minimum will be achieved at the point this procedural document requires a review e.g. changes in legislation, findings from incidents or document expiry.

Relationship of this document to other procedural documents
This document is a standard operating procedure applicable to the Norfolk and Norwich University NHSFT

Contents Page

1. Introduction

1.1. Rationale

All imaging investigations should be protocoled to ensure consistent and standardised practice.

1.2. Objective

Appropriately trained Radiographers & Assistant Practitioners will carry out the examinations to the required standard and be responsible for attaining high quality images, within the scope of their practice.

1.3. Scope

This guideline applies to all Radiographers & Assistant Practitioners undertaking plain radiography imaging for adult patient 16 years old and over.

1.4. Glossary

The following terms and abbreviations have been used within this document:

Term	Definition
HCPC	Health Care Professions Council
QA	Quality Assurance
SCoR	Society & College of Radiographers
SOR	Society of Radiographers
RIS	Radiology Information System
PACs	Picture Archiving Communications System
LMP	Last Menstrual Period
DRL	Diagnostic Reference Level

2. Responsibilities

All Radiographers and Assistant Practitioners working in General Radiography are responsible for ensuring they are familiar and work to the processes described in this process.

3. Policy Principles

3.1. General Guidelines

All Radiographers should be registered with the Health & Care Professions Council (HCPC) and are required to adhere to the following standards of practice:

- HCPC Standards of Proficiency for Radiographers
- HCPC Standards of conduct, performance and ethics
- SCoR relevant standards of conduct (www.sor.org)

The Radiographer & Assistant Practitioner should:

- Recognise his/her scope of practice and work within their boundaries;

- The Assistant Practitioner should practice in accordance with the Radiology Assistant Practitioner Guidelines.
- Be familiar with local radiographic projection protocols;
- Be familiar with referral criteria and clinical indications, in order to be competent in authorising radiographic requests (see Royal College of Radiologists referral guidelines, iRefer, accessible on Trust intranet);
- Accept properly delegated responsibility, in accordance with local practice and guidelines.

A radiographic exposure should not be carried out unless a valid request has been received. The request should include such clinical details as are relevant to the examination, clear identification of the person requesting the examination and to whom the report should be directed, as described in the Employer's Procedures.

The following general polices should also be read and understood by all Radiographers & Assistant Practitioners:

- Local Rules (displayed in each room and on the intranet)
- Employer's Procedures
- Ionising Radiation Safety Policy
- Operational Policies - Departmental & area specific

All policies are accessible on the Radiology intranet pages and via Trust Docs.

3.2. Equipment and Quality Assurance Testing

A quality assurance (QA) program is maintained by a team of appropriately trained QA staff. All relevant policies and protocols can be accessed on the Radiology intranet pages. The program includes:

- Equipment testing as per schedule described in relevant policies;
- Rejection analysis (monthly)
- Image quality audits (ad-hoc)

The Radiographer & Assistant Practitioner is expected to:

- Have appropriate knowledge of imaging equipment to ensure that it is appropriate for purpose;
- Manipulate the equipment correctly so that patient diagnosis and management are not compromised;
- Manipulate exposure factors correctly to ensure high quality images (exposure guides are in each room).

3.3. Communication

Whilst undertaking any radiographic examination and working in accordance with locally agreed practice, the Radiographer & Assistant Practitioner should:

- Obtain sufficient written and verbal (if appropriate) information from the referring clinician to undertake correctly the examination requested;
- Be mindful of the need to use interpreters as and when necessary to communicate adequately with the patient;
- Greet the patient using his or her full name and title as appropriate;
- Check the patient's identity by asking them to confirm their name, date of birth and address (or hospital number via the wristband) in accordance with the Trust Policy and procedure for the positive identification of patients – this information should be sought from the patient rather than asking them to confirm the information;
- Be able to discuss the relative risks and benefits of the examination with the patient;
- Explain the procedure appropriately to the patient;
- Obtain informed consent from the patient or their representative being mindful of his/her capacity to understand;
- Be aware of the individual patient's special needs including chaperoning and privacy / dignity during the examination;
- Assess whether a mental capacity assessment is required, and undertake as appropriate;
- Be professional and understanding throughout the examination; manage the interaction between the patient and any accompanying adults and children in a way that enables the examination to be carried out to a competent standard;
- Ensure appropriate arrangements have been made for further care before the conclusion of the examination if appropriate;
- Inform the patient how they should expect to receive the results of their examination;
- "Red Dot" an image if a fracture / pathology is demonstrated, as an indication only to the referring clinician; further information on why the image has been "red dotted" should be added to the RIS notepad, ie, a comment to indicate to the reporter what the red dot has been placed for. See the SoR guidance on Preliminary Clinical Evaluation for more information.

3.4. Managing the Obese Patient

All tables and trolleys have weight limits, therefore limiting imaging of the morbidly obese.

Hip Trolleys:	25 stone (158kg) maximum
X-ray Tables:	23 stone (150kg) for unrestricted table movement
	35 stone (227kg) with **NO** table movement

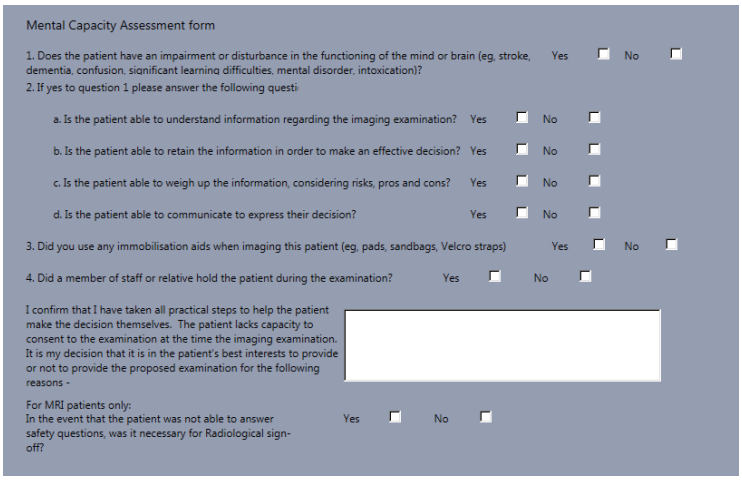
Bariatric trolleys are available throughout the Trust, or via the Equipment Library. For any additional equipment, please contact the Equipment Library (bleep 0944).

3.5. Managing patients who do not have mental capacity

To ensure that Radiology complies with the Mental Capacity Act (2005), a form has been created on RIS to record our assessment of a patient's mental capacity when undergoing X-rays. Record whether the patient has mental capacity by answering the questions on the form and record what action was taken to ensure patients were supported to make decisions about their care.

Please note that if it is in the best interests of the patient to undertake imaging and they do not have mental capacity, the imaging can go ahead – that is a judgement we make as healthcare professionals in the best interests of our patients.

Please complete for all patients who have a mental impairment, permanent or temporary.


Mental Capacity Assessment form

1. Does the patient have an impairment or disturbance in the functioning of the mind or brain (eg, stroke, dementia, confusion, significant learning difficulties, mental disorder, intoxication)? Yes ☐ No ☐

2. If yes to question 1 please answer the following questi

a. Is the patient able to understand information regarding the imaging examination? Yes ☐ No ☐

b. Is the patient able to retain the information in order to make an effective decision? Yes ☐ No ☐

c. Is the patient able to weigh up the information, considering risks, pros and cons? Yes ☐ No ☐

d. Is the patient able to communicate to express their decision? Yes ☐ No ☐

3. Did you use any immobilisation aids when imaging this patient (eg, pads, sandbags, Velcro straps) Yes ☐ No ☐

4. Did a member of staff or relative hold the patient during the examination? Yes ☐ No ☐

I confirm that I have taken all practical steps to help the patient make the decision themselves. The patient lacks capacity to consent to the examination at the time the imaging examination. It is my decision that it is in the patient's best interests to provide or not to provide the proposed examination for the following reasons -

For MRI patients only:
In the event that the patient was not able to answer safety questions, was it necessary for Radiological sign-off? Yes ☐ No ☐

3.6. Medical Exposure & Pregnancy

The Directorate regards any female between the ages of 12 and 55 to be of childbearing age. If any persons in this group are to undergo an investigation that involves irradiation of the pelvis (practically considered being radiological views taken between the knees and the diaphragm), the following precautions must be taken.

During the identification process prior to the medical exposure being carried out, females of childbearing age should be asked of the possibility that they are pregnant. Where there are multiple operators for an exposure, the operator initiating the exposure will be responsible for ensuring that this question has been asked.

LMP/pregnancy status should be recorded electronically on RIS when doing Examination Details - the "Pregnancy checked" box should be ticked, and in the drop down field, indication as to whether the patient is pregnant or not, with any relevant notes regarding LMP status, pregnancy test results or reasons for non-pregnancy, e.g., contraceptive pill, pre-menarche, sterilisation/hysterectomy, added to the notepad. Patient alerts can also be added in the event that the patient has had a hysterectomy for example, for future attendances.

Please refer to Employer's procedures for further guidance.

3.7. Guide to Radiographic Projections

This section is designed to act as a guide to aid in the standardisation of radiographic projections ensuring a diagnostic examination whilst minimising patient dose.

All Radiographers & Assistant Practitioners should read this document regularly and keep themselves informed of any amendments to projections.

General criteria for all examinations:

- The Radiographer or Assistant Practitioner responsible for the examination must ensure that all the details are correct on the request prior to examining the patient.
- The request must be justified/authorised by either a Radiologist or Radiographer and recorded on RIS as such.
- Post-examination details must be entered onto the Radiology Information System for **all** patients. This must include dose (and/or exposure factors), room identification, operator ID, pregnancy status, holder's details (where relevant), start and finish time, and any relevant notes (eg, reasons for exceeding DRL, difficultly of examination, reasons for missing projections, reasons for red dot).
- Anatomical markers must be accurately placed on all radiographs. Regular spot checks and audits are undertaken.
- All pregnancy statuses must be recorded on RIS electronically, by responding to the question "Is the Patient Pregnant? > Yes/No" and ticking the Pregnancy checked. It may also be appropriate to record the reason (eg, hysterectomy) as a Flag on the patient's record on RIS.

  Inputting of pregnancy data is mandatory on RIS for all patients 12-55 years for relevant examinations.
- Accurate collimation is essential and should be evident on all radiographs – **ensure images are sent to PACS in a presentable format for viewing by both Radiologists/Reporting Radiographer and the referrer.**
- Programmed exposures and the Exposure Guides should be used only as a guide. The Radiographer and Assistant Practitioner should ensure that doses arising from the exposure are kept as low as reasonably practicable consistent with the intended purposes.
- Any faults relating to the equipment must be reported immediately to the Team Leads.
- Accessory equipment is an integral part of a radiographic examination. Check for availability prior to commencing an examination and report any deficiencies.

- The clinical indications presented in this guideline are not exhaustive.

Radiographers and Assistant Practitioners should be familiar with the Royal College of Radiologist's referral guidelines "iRefer: Making the best use of clinical radiology available on the Trust intranet.

3.8. General MSK Referrals

This section describes indications for plain radiographic imaging based upon clinical information and conditions that affect multiple joints/anatomical areas, rather than anatomical area, and is based upon iRefer guidelines.

Clinical Indication	?indicated as per iRefer	Notes
Osteomyelitis	Indicated	• X-ray is the initial investigation but may be normal in early osteomyelitis; • Radiographs have a low sensitivity for osteomyelitis immediately following a penetrating injury. • Ensure the whole anatomical area is imaged when osteomyelitis suspected (eg, undertake feet projections when ?osteomyelitis hallux)
Bone pain / unresolving bone pain	Indicated	• X-ray gives a dedicated view of the symptomatic area. • Will have MRI if there is a positive finding on X-ray.
Metabolic bone disease	Indicated	X-ray is helpful in the identification of osteoporotic collapse and differentiation from other unrelated causes. It also identifies characteristic signs of other metabolic bone disease, including osteomalacia and hyperparathyroidism. It is important in correlation with NM abnormalities.
Suspected osteomalacia with pain	Indicated	Localised radiographs are used to establish the cause of local pain or an equivocal lesion following a nuclear medicine scan.
Arthropathy (initial presentation)	Indicated	• X-ray of the affected joint may be helpful to establish cause, although erosions are a relatively late feature. • **XR hands/feet:** In patients with suspected rheumatoid arthritis, XR of the feet may show erosions even when symptomatic hand(s) appear normal. • **Other anatomical areas:** X-rays indicated for symptomatic joints only
Painful prosthesis	Indicated	X-ray is useful to detect established loosening.
Arthropathy (follow-up)	Specialised investigation	X-ray may be required by specialists to assist management decisions; eg for instituting and modifying drug treatment and referral for joint replacement.
Soft tissue mass	Indicated only in specific circumstances	• US is the first line investigation

		• X-ray is only useful if lesion is close to bone or for assessment of internal calcification.

3.9. Upper Extremity

Examination Type	Indication	Contraindications	Radiographic Projections	Notes
Hand	• Trauma • Arthropathy/metabolic bone disease • Pain • ? Foreign Body • Bone age		• **Trauma:** DP & Oblique • **Punch injury/dorsal MC soft tissue swelling:** DP, oblique & lateral. • **Arthropathy**: DP both hands • **Foreign body**: DP and lateral/tangential of wound • **Bone age:** Non-dominant hand and wrist- Appendix 1	**GP requests arthropathy:** change to both Hands and indicate when vetting which side was requested.

Finger	• Trauma • Pain • ? foreign body • Dislocation • Prosthesis	• DP (of affected and adjacent finger) & true lateral, to include CMCJ on **both** radiographs. • An oblique is required if clinical information indicates injury to proximal phalanx base, metacarpal head or MCPJ (hyperextension injury).	For FB, place marker adjacent to site of entry **True lateral projection essential for all finger examinations.**

Thumb	• Trauma
	• Pain
	• ? foreign body
	• Prosthesis
		• **Trauma:** AP (or DP if patient in ++pain or limited mobility) & true lateral
		• **GP thumbs ?OA: DP both hands only**
		• **Orthopaedic thumbs ?OA/pain:**
		  ○ AP thumb (Robert's view) +
		  ○ Lateral thumb +
		  ○ DP full hand.
			DP both hands only needed for GP referred ?OA thumb - do not perform specific thumb images
			
			Orthopaedic: only attempt DP if patient in severe pain or limited mobility

Wrist & Scaphoid	• Trauma / pain
	• Arthropathy
	• Prosthesis/fixation
	• Scaphoid films repeat 10 –14 days after injury if clinical signs of fracture and initial XR negative
	• Ligamentous instability
		• **Trauma:** DP, lateral and oblique
		• **Non-trauma:** DP and lateral
		• Scaphoid –
		  ○ DP with ulnar deviation
		  ○ DP with ulnar deviation & tube angled 20° cephalad
		  ○ DP oblique
		  ○ Lateral
		• **Ligamentous instability:** clenched fist projections (see Appendix 2)
			If dislocation of distal radio-ulnar joint or severely displaced radial shaft fracture is seen, undertake localised views of elbow to exclude dislocation/fractures.
			
			If scaphoid requested in the trauma setting, perform full scaphoid views regardless of area of pain.
			
			Oblique wrist – not required on post-plaster trauma radiographs.
			
			Anatomical tilt views requested post DVR plate to visualise articular surface and screw placement. Circa 23 degree angle towards elbow on lateral

				view and 11 degrees towards elbow DP view.

Examination Type	Indication	Cont	Radiographic Projections	Notes

		r a i n d i c a t i o n s		
Radius & ulna	• Trauma • Pain • Prosthesis		• AP in supination • Lateral NB: it is important to have a good lateral projection with wrist, elbow, shoulder all same height	If abnormality demonstrated at elbow or wrist joints, localised views may be helpful. Mid shaft fracture - include wrist and elbow.
Elbow	• Trauma / Pain • Prosthesis • Degenerative changes • Arthropathy		• AP • Lateral	
Humerus	• Trauma • Pain • Pathological processes • Prosthesis		• AP with external rotation • PA /lateral with internal rotation.	Important to include both joints. See notes on “Shoulder” regarding trauma.

Clavicle	• Trauma
	• Pain
	• Plating of clavicle
	• ACJ instability
			• **Trauma**:
			  ○ AP to include *entire shoulder girdle*;
			  ○ Coned 20* cephalad on all trauma requests;
			  ○ Axial shoulder if distal clavicle fracture seen.
			• **Outpatient**: coned AP & AP 20* cephalad	

Scapula	• High force blunt trauma • Focal bony lesion		• AP shoulder girdle • Lateral (Y-view)	Modified axial to assess glenoid adequately may be appropriate in some cases
Acromio-clavicular joints	• Trauma (? Subluxation) • Pain		• Straight AP of entire shoulder girdle (affected side only) • Additional views may be appropriate depending on imaging findings, eg, axial, coned 20* cephalad	AP weightbearing views are rarely indicated and definitely **not in the acute setting.**
Examination Type	**Indication**	**Contraindications**	**Radiographic Projections**	**Notes**

Sterno-clavicular joints	• Trauma ?medial clavicle fracture • ? dislocation/subluxation – Orthopaedic requests only.	Any other request to be seen	**Trauma:** ?medial clavicle fracture/dislocation – standard clavicle views only. **All other referral sources and clinical indications:** plain film contraindicated – US most appropriate examination.	

		ications should have an US		
Shoulder	• Trauma • Pain • Dislocation (incl. recurrent) • Calcification • Degenerative changes • Prosthesis • Instability (to demonstrate bony lesions in humeral head/glenoid)		• **Trauma/FU trauma**: ○ Straight AP ○ Axial/modified axial. • **GP, Rheumatology requests & non-trauma orthopaedic requests**: ○ 15 degree turned AP ○ Axial	**Trauma**: if Humerus views requested by ED and proximal fracture seen, proceed to shoulder series views only (do not complete humerus series) All GP referrals for US Shoulder should also be referred for X-ray Shoulder

3.10. Lower Extremity

Examination Type	Indication	Contraindications	Radiographic Projections	Notes

Foot	• Trauma • Forefoot pain of uncertain cause • Arthopathy • Foreign body • Orthopaedic assessment of bones, joints and alignment • **Podiatry requests:** ○ Subungual problem of both hallux ○ Hallux valgus and forefoot problems ○ Sesamoid and frontal problems – DP hallux projection only ○ Mid and rear foot problems ○ Congenital Talipes Equinovarus	Morton's neuroma Plantar fasciilitis Calcaneal spur	• **Trauma:** DP & oblique (include whole calcaneum and lateral/medial malleolli). • **Arthropathy:** DP both feet. • **Forefoot pain:** DP both feet & oblique affected foot • **Foreign body:** DP and lateral/tangential of wound with skin marker. • **Orthopaedic referrals:** Appendix 3. • **Charcot foot:** DP, oblique & lateral whole foot (incl. ankle). • **Podiatry:** ○ DP, oblique & lateral are standard projections; ○ Other projections are discretional and depend upon clinical information.	If Lisfranc #/dislocation demonstrated, perform lateral foot as additional view.
Hallux	• Trauma • Pain		• DP & lateral • Undertake oblique if fracture seen in region of MTP joint	Oblique may be acceptable dependent upon patient condition/mobility

Justification Criteria & Technique Guide for Plain Radiological Examinations

Examination Type	Indication	Contraindications	Radiographic Projections	Notes
Toes (2^{nd} – 5^{th})	• Trauma – only if toe is visibly deformed or open fracture		• DP & oblique	
Calcaneum	• Trauma • Osteomyelitis	Spur; Plantar fasciiitis (US/MRI indicated)	• Lateral & axial with 40° angulation cranially	Foot must be in dorsiflexion to demonstrate the subtalar joints (use bandage if patient unable to dorsiflex adequately).
Tibia & Fibula	• Trauma • Bone pain ?lesion • Ilizarov frame • Spatial Frame		• AP & lateral to include both joints • **Spatial Frame protocol** (Appendix 4)	For ankle injury, undertake true mortice & lateral to assess joint stability.
Ankle	• Trauma (re: Ottawa Rules)		• Trauma: AP (mortise) and lateral to include base of	If # demonstrated on 5th MT,

	• Pain • Arthropathy • Reconstruction / replacement		5th metatarsal • Ankle reconstruction/fusions: see Appendix 3 • Subtalar joints: Broden's views • Podiatry requests: WB DP & lateral	undertake DP & oblique foot projections to ensure no further fracture. If transverse medial malleolus fracture demonstrated, undertake AP/lateral projections of the knee to look for further proximal fractures.
Femur	• Trauma • Bone Pain • Pathological processes/focal bony lesions • Prosthesis / fixation • Leg alignment		• AP pelvis + femur projections • HB lateral for trauma • Leg Length Measurements (see Appendix 6)	Where a patient has suffered a hip/proximal femur fracture and has a history of cancer/mets, undertake femur views to determine if any focal bony lesions and aid surgical management.
Examination Type	**Indication**	**Contraindications**	**Radiographic Projections**	**Notes**

Knee **(non-traumatic pain without locking)**	• **GP requests will only be accepted for patients >50 years old** • Acute swelling <24hrs • Monoarthritis • Severe pain out of proportion to usual symptoms • Fever • Infection (risk factors include recent surgery, RA, immunocompromised, adjacent skin infection) • Rest pain/morning stiffness • Joint swelling, tenderness & warmth	**GP referrals <50 years old –** MRI only. Osgood Schlatters – refer to Paediatric Radiolog	• AP (Weight bearing if patient >40 years old) • Lateral • 30° skyline	Orthoview measurements for orthopaedic-referred patients > 55 years (see Appendix 5) - will be specified on request if required.

		ist		

Knee **(non- traumatic pain with locking)**	Identify radiopaque loose bodies		• AP (Weight bearing if patient >40 years old) • Lateral • 30° skyline • Intercondylar	
Examination Type	**Indication**	**Contrain dications**	**Radiographic Projections**	**Notes**
Knee **(trauma requests)**	Trauma – fall, twisting injury, blunt trauma		• Supine AP • Horizontal beam lateral • 30° skyline • Intercondylar projection – loose bodes suspected or seen on radiographs	If the patient presents with a mechanism of injury suspicious for a patella fracture, or any fracture/lipohaemarthrosis is seen on the AP/lateral projections, **do not undertake skyline or intercondylar views**. Similarly, if the patient cannot flex their knee adequately, do not attempt a skyline/intercondylar.

3.11. Pelvis and Hip

Examination Type	Indication	Contrain dications	Radiographic Projections	Notes
Pelvis & hip **(GP & rheumatology requests)**	• Arthropathy/erosive changes • Persistent pain • Metastatic disease/focal pathology • Avascular necrosis (NAD in first 6-9 months) • Trauma • Dislocation prosthesis • Peri-prosthetic # • Dysplasia • Femoroacetabular impingement • Assessment for wheelchair size/shape		• AP Pelvis (iliac crests down) • Turned lateral	For ?periprosthetic fracture, include sufficient normal bone beneath prosthesis and spacer/all cement on both projections. HBL very effective in excluding subtle impacted fractures. Requests for wheelchair assessments may include other anatomical areas.
Pelvis & hip **(Orthopaedic requests)**	• Pre-op/post-op/follow-up THR/hemiarthroplasty • Loosening prosthesis • Arthropathy		• AP (ASIS down) • Horizonal beam lateral – post-ops • Turned lateral – follow-up prosthesis and all other requests	Ensure spacer and cement is included on post-op & follow up images on **both** projections Where un-cemented femoral components have been used, images should show **beyond** the tip of the THR stem. Orthoview measurements for pre-op THR (Appendix 5).

Examination Type	**Indication**	**Contraindications**	**Radiographic Projections**	**Notes**
Pelvis & hip **(trauma requests)**	• Trauma – fall, blunt trauma • ?periprosthetic fracture		• **Trauma:** AP Pelvis (iliac crest down) & HBL lateral • If there is trauma to the femur, undertake AP pelvis (iliac crests down) and femur projections	Where a patient has suffered a hip/proximal femur fracture and has a history of cancer/mets, undertake femur views to determine if any focal bony lesions and aid surgical management.
Pelvis	• Post-operative acetabular fractures	Acute diagnosis of acetabular fractures – CT indicated	• AP Pelvis & Judet projections	See Appendix 7; requested by Consultant/Senior SpR only Judet projections should only be performed M-F 0900-1700
Pelvis	• Confirmed pelvic ring fracture		• AP Pelvis & inlet/outlet projections	See Appendix 7; requested by Consultant/Senior SpR only Inlet/outlet projections should only be performed M-F in core hours

SIJ / sacrum	• Arthopathy – will be requested by Rheumatology normally	Contraindicated for GP referrals	• AP 15-20* angle cephalad or • PA 15-20* angle caudad	

3.12. General AXR Referrals

This section describes indications for plain radiographic imaging based upon clinical information and conditions, rather than anatomical area, and is based upon iRefer guidelines. Abdomen radiographs often have limited value and should be requested with caution.

Where an AXR is “Indicated only in specific circumstances” (as per the below table), additional information should be provided on the request/sought from the referrer to justify an abdominal radiograph.

Clinical Indication	?indicated as per iRefer	Notes
Acute ***small*** bowel obstruction: confirmation and assessment of level	Indicated	AXR may show if bowel obstruction is present but cannot exclude it nor determine the underlying cause in most cases. Clinically, small, and large bowel obstruction are difficult to differentiate.

Inflammatory bowel disease of the colon: acute exacerbation	Indicated	AXR is useful to diagnose and monitor toxic dilatation.
Renal calculi in absence of acute colic (usually following a CT KUB)	Indicated	Less accurate than CT but has lower dose and is still adequate in routine practice to detect majority of renal calculi. If calculi can be identified on AXR/US, they should be followed up as such to minimise radiation dose from multiple CT exams.
Acute abdomen with suspected large bowel obstruction	Indicated only in specific circumstances	Helpful in limited cases of large bowel dilatation: • Known sigmoid volvulus as the possible cause of large bowel obstruction • Ulcerative colitis with suspected toxic megacolon
Renal failure (acute and chronic kidney injury)	Indicated only in specific circumstances	AXR can show calculi not detectable by US but is far less sensitive than low-dose CT
Suspected ureteric colic	Indicated only in specific circumstances	Indicted alongside US in children and pregnant women, or when CT is inappropriate/cannot be used.
Constipation	Indicated only in specific circumstances	AXR may be useful in the elderly to show the extent of faecal impaction but does not diagnose constipation.
Acute abdominal pain warranting hospital admission for consideration of surgery	Erect CXR ± AXR only indicated in specific circumstances	Erect CXR is sensitive for detection of free intra-peritoneal gas and should be performed when the patient has been erect/semi-erect for at least ten minutes. Supine AXR may be helpful in patients who may have obstruction due to adhesions or in the postoperative period to distinguish prolonged paralytic ileus from obstruction.
Pancreatitis: acute	AXR & CXR indicated only in specific circumstances	XRs are rarely contributory in diagnosis. When patients present with non-specific acute abdominal pain, AXR may show bowel dilatation. Erect CXR can detect perforation and demonstrate pleural and pulmonary pathology.
Pancreatitis: chronic	AXR & CXR indicated only in specific circumstances	AXR is far less sensitive than CT but may show calcification (rare) when CT is not feasible.
Palpable abdominal or pelvic mass	Indicated only in specific circumstances	AXR is rarely of value. It may be useful for suspected volvulus or bowel obstruction, although these patients frequently require CT anyway.

Upper urinary tract obstruction: diagnosis and causes	IVU **Indicated only in specific circumstances**	IVU may be used to define anatomy before surgery or other intervention **in rare circumstances where CT is not available.**
Urinary tract infection in adults	Imaging only indicted if: • If infection does not settle rapidly with antibiotics • After infection has settled in men with one proven UTI or in women with a proven recurrence of UTI • In immunocompromised or diabetic patients.	US ± AXR: US first to exclude abscess and renal pelvic dilation; US & AXR helpful combination to investigate UTI with lower dose than CT, however this is considered a specialised investigation. IVU has no value in this instance.
Acute upper GI bleeding: haematemesis/malaena	Not indicted	AXR is of no value
Biliary pain: suspected gall bladder disease or post-cholecystectomy pain	Not indicated	AXR shows only about 10% of gallstones

3.13. Abdomen

Examination Type	Indication	Contraindications	Radiographic Projections	Notes
Abdomen	• Suspected bowel obstruction, to assess level of obstruction • Inflammatory bowel disease – acute exacerbation • Toxic dilatation / toxic megacolon • Concealed drug packages (See Forensics Protocol) • Ingested Radio-opaque FB	• Non-specific abdominal pain • Abdominal mass (US) • Cholecystitis (US) • Appendicitis (clinical diagnosis) • Pyelonephritis (US) • Haematemesis (endoscopy) • PR bleed/malaena (endoscopy ± CTC)	• Supine AP abdomen • Acute abdomen: ○ AP supine abdomen and erect CXR (if perforation suspected). Patient to sit erect for at least 5 mins before examination (right	For swallowed/ concealed packages, see **Forensics Policy** Abdomen shapes studies are undertaken to assess intestinal transit pathology. Documentation brought with patient and scanned into

	• EVAR / urology stent F/U • Abdominal pain warranting hospital admission & consideration for surgery • 24 Hour post gastrografin for small bowel obstruction • Patency capsule check – for patients with IBD prior to pillcam. • Follow-up stones	• Diverticulitis (endoscopy ± barium enema) • Abdominal trauma (US/CT) • Ascites (US) • AAA (US/CT/MRI) • Diagnosis inflammatory bowel disease (fluoroscopy) • Pancreatitis (US/CT) • Palpable mass (US/CT/MRI) • Jaundice (US/CT/MRI/ERCP/endoscopy/ PTC) • Cirrhosis (US/MRI/CT) • Renal colic ?stones (CTU)	decubitus if erect not possible) • Follow-up renal stones: cone laterally to ASIS • Kidney cancer: when CT is not feasible, IVU is an alternative for excluding urothelial tumours	PACS. Post gastrografin studies should be performed 24 hours after gastrografin has been administered. Patency capsule checks can be variable in time. An appointment will be booked for the patient; however they will attend “around” this time on the day appointed (they are aware when to attend) All patency capsule X-rays should be reviewed by a Radiologist prior to patient leaving the Department (see Appendix 14)

3.14. Thoracic Cage

Examination Type	Indication	Contraindications	Radiographic Projections	Notes
Chest	• Acute chest pain? STEMI MI / heart failure/ ACS /Unstable Angina • Congenital heart disease • Chronic stable angina • Pericarditis / pericardial effusion • Valvular heart disease • Pulmonary embolism (also indicated during pregnancy) • Pleural effusion(Erect only) • Pleuritic chest pain • Non-specific PERSISTENT Chest Pain • Consolidation • Chest infection / pneumonia • Pyrexia unknown origin (PUO)/ Septic Screen • Inhaled/swallowed FB - if respiratory symptoms develop (to show oesophageal and tracheo-bronchial opaque foreign bodies as well as the complications; e.g., collapse) • Chest trauma / blunt/penetrating trauma • Haemoptysis • Malignancy (primary) • Metastases, including of unknown primary origin	• Pre-operative - **not indicated unless:** ○ Pre-op thoracic/cardiac surgery ○ Pre-op breast surgery ○ Pre-op vascular surgery ○ Where the patient has known or suspected malignancy, aged under 60 with cardiac or respiratory disease. ○ Where the patient is an immigrant (UK category 2) having arrived in the country within the previous year and has not had a chest x-ray. ○ Occupational purposes (e.g.Diver) ○ Patient >60 years with significant cardiorespiratory disease • Asthma (unless acute exacerbation that is life-threatening or does not respond to treatment, e.g., GP referral with other symptoms. • Repeat prior to hospital discharge (in patients with satisfactory clinical recovery) FU 4-6-12 weeks should be arranged.	• PA erect where possible • AP erect if PA not possible • Supine for spinal/pelvic trauma & A&E trauma patients • Haemoptysis for over 40's - PA/AP & lateral to demonstrate any potential lesions (do not undertake lateral projection on patients under 40). • Pacemakers - PA & lateral • PICC lines – ensure patient's arms are placed by their sides so that line position is not distorted/changed.	Apical views may be requested by Radiologist to demonstrate apical lesions. Nipple markers may be used if necessary. Ensure non-rebreather oxygen mask is projected away from lung fields (or if not possible annotate on image) as can mimic pneumothorax. Large Pleural effusion : Also see SOP for referral of Patient to the Pleural Effusion Clinic in the event of finding a pleural effusion on CXR (TD 14124) Bone subtraction auto applied to all chests on the Samsung rooms **Oesophageal perforation:** CXR will be abnormal in 80% of cases, but pneumomediastinum is visible in only 60% of cases.

	• ?TB
	• Lung Nodule FU
	• Dyspnoea
	• Weight loss
	• Hoarseness
	• Clubbing
	• Supraclavicular or cervical lymphadenopathy
	• Thrombocytosis/Raised ESR
	• Pneumothorax/suspected pneumomediastinum
	• Respiratory difficulty (at rest / on exertion) SOBOE
	• ITU/HDU patient – where change in symptoms or insertion/removal of a device
	• ? NGT placement unable to aspirate
	• CVC line / PICC/ Hickman etc.
	• Position of catheters/tubes/ET tube
	• Bowel / oesophageal perforation
	• Pacemaker localisation
	• Occult lung disease
	• Exacerbation of COPD
	• Covid pneumonia
		• Upper respiratory tract infection.
		• Expiratory CXR for pneumothorax
		• ?Aortic dissection –US/CT indicated
		• ?Covid (additional clinical information is required to justify the request)
		• Post 3CG BARD PowerPICC line insertion, unless:
		  ○ Atrial fibrillation/Flutter
		  ○ Pacemaker in-situ;
		  ○ No consistent P wave;
		  ○ New Practitioner (first 50 insertions require CXR).
				Lung cancer can have a variety of different clinical presentations. Urgent CXR is indicated for:
				• Unexplained haemoptysis in patients aged 40 and over
				• Persistent or recurrent chest infection
				• Persistent cough (for >3 weeks)
				• Chest pain
				• Dyspnoea
				• Weight loss
				• Hoarseness
				• Clubbing
				• Supraclavicular or cervical lymphadenopathy
				• Thrombocytosis.

Sternum	• Major blunt trauma		• PA/AP CXR • Lateral sternum	
Thoracic inlet	• Swallowed foreign object • ? tracheal compression • Retrosternal mass	Goitre (US)	• Lateral with valsalva to include nasopharynx and carina • AP view coned to inlet	Valsalva technique for both projections

Soft tissue neck	• Ingested FB (eg, some fish bones)		• Lateral with val salva to include nasopharynx and carina	List of radiopaque fish bones and other items in Appendix 13 .

3.15. Foreign Bodies

Examination Type	Indication	Contraindications	Radiographic Projections	Notes
Foreign Body	• ?FB – referrer should indicate where and what the foreign body is as this will determine if a radiograph is the correct examination to locate a foreign body. Please see appendix 13		• A single AP/Lat view my not be totally sufficient in every case. Often two views will be required or further views to fully assess the location of the foreign body. • A tangential view of the foreign body can be useful for demonstrating the depth of the foreign body below the skin and if the FB penetrates the cortex of any bone. • At least one joint should be visible on the radiograph wherever possible • A marker at the entry sight should be used as a useful tool for locating FB's • Ensure the sight marker is not confused with the foreign body	• The radiological appearance in plain radiography of foreign bodies is dependent on three factors: the x-ray attenuation of the foreign body, the surrounding structures and any overlying structures that may veil the object. Please see appendix 13 for a list detailing degree of radio-opacity of some common foreign bodies. • The anatomical location will not only affect the radio-opacity of the suspected foreign body, but the rate of magnification as the object is placed further or closer to the detector. • For FB radiographs of coins a chest radiograph is sufficient to assess whether

				the location of the coin is below the diaphragm • Abdominal radiographs should only be undertaken when assessing the location of batteries which can degrade within a few hours or objects that could potentially cause perforation. Subsequent radiographs can be undertaken to track passing of the FB.

3.16. Vertebral Column

Examination Type	Indication	Contraindications	Radiographic Projections	Notes
Cervical Spine	**GP referrals:** • Trauma >50 years old • Pre-op RA • Cervical rib • Atlanto-axial subluxation **Trust referrals:** • Trauma • Pre-op RA • Cervical rib • Atlanto-axial subluxation • OA/RA • Neurological signs	**GP referrals** • Patients < 50 years old • OA	• **Trauma:** - AP - Odontoid peg - HBL - Swimmers (if C7/T1 not seen on lateral) • **GP referrals ? trauma/wedge fracture:** <u>lateral</u> projection only • **Pre-op RA:** AP and lateral • **Cervical rib** – AP only – to include all of 1st rib • **Atlanto-axial subluxation:** lateral flexion and extension projections	Trauma F/U flexion/extension patients should be held by requesting Consultant/SpR.

Thoracic Spine	**GP referrals:** • Trauma / focal pain >50 years old; • ? osteoporotic vertebral fracture **Trust referrals:** • Trauma / focal pain; • ? osteoporotic vertebral fracture • Neurological signs • Metastatic disease • Metabolic/congenital disorders • OA/RA • Prosthesis / post-op • Pre-op	**GP referrals** • Patients < 50 years old • OA	• **Trauma:** AP & HBL • **GP referrals:** standing or supine **lateral** projection only • **Non trauma Trust referrals:** AP and lateral (standing or supine) • **Orthopaedic:** standing AP & lateral projections	Osteoporotic #: low threshold for MRI if plain films normal All CT chests now have spinal reconstructions, check if recent CT undertaken.
Lumbar spine, sacrum & coccyx	**GP referrals:** • Trauma / focal pain; • ? osteoporotic vertebral fracture **Trust referrals:** • Trauma / focal pain; • ? osteoporotic vertebral fracture • "Red flag" features • Metastatic disease / primary tumour / neoplasia • Congenital anomaly • OA/RA • Post-op / prosthesis • Pre-op	**GP referrals** • Patients < 50 years old • OA Coccyx; Infection/discitis: MRI should be requested **GP requests:** OA, red flag features/metastases – MRI should be requested.	• **Trauma:** AP & BHBL All acute trauma images should be performed supine. Standing images can only be performed at the request of a Consultant (A&E or Orthopaedic) after supine films have been undertaken and ***should never be first-line investigation in A&E.*** **It is the referrer's responsibility to ensure that the patient is clinically stable to be able to stand.** • **GP referrals:** standing or supine **lateral** projection	Osteoporotic #: low threshold for MRI if plain films normal L5/S1 projection only to be performed if not adequately demonstrated on the lateral view. All CT abdos now have spinal reconstructions, check if recent CT undertaken.

	•		only • **Non trauma Trust referrals:** AP and lateral (standing or supine) • **Orthopaedic:** standing AP and lateral projections	

3.17. Skull / Facial Bones / Mandible

Examination Type	Indication	Contraindications	Radiographic Projections	Notes
Skull	• Mechanical shunt failure • Depressed # • Ping pong paediatric # • NAI • Myeloma / mets • Aneurysm clips pre-MRI		• Discuss with Consultant Radiologist • See intranet for NAI protocol Aneurysm clips pre-MRI - lateral skull only	All skull XR requests should be discussed with and vetted by a Consultant/Duty Radiologist or Paediatric Consultant Radiologist
Facial Bones	• Trauma		• OM & OM 30*	Note: fluid levels do not show

	• Blunt orbital trauma • Middle third facial injury • Post-operative fixation			on supine views.
Tempero-mandibular joints (TMJ)	• Trauma • ? dislocation / dysfunction	TMJ requests from GPs – OPG or MRI more appropriate	• OPG • TMJ: open & closed mouth (ED and Oral Health referrals only).	
Mandible	• Trauma • Follow-up/post-op fixation • Cysts • Abscess / infection		• **Trauma:** OPG & PA mandible • **Non-trauma:** OPG only	If OPG not possible, undertake AP/PA & lateral oblique mandible views.
Orbits	• ? foreign body for MRI / AE • Trauma ? # • Penetrating injury		• **FB (pre-MRI):** coned view of both eyes with eyes in neutral position • **FB (trauma):** affected eye only.	If positive for metallic elements, refer images to Radiologist, who will decide whether further imaging is necessary.
Teeth	• Trauma • Dental Assessment • Abscess		• OPG • Peri-apicals (for dental requests only)	

For further information on dental radiography, please see Dental Protocols & Justification criteria, accessible on Trust Docs.

3.18. Trauma

Examination Type	Indication	Contraindications	Radiographic Projections	Notes
Trauma Series	• RTC • Fall from height • Various mechanisms of trauma resulting in multiple injuries		• Lateral cervical spine • AP Pelvis (**must** include iliac crests) • Supine CXR	Performed in ED Resus or in Department. NB: not all projections will always be required – it is rare for a cervical spine to be performed in Resus due to NICE guidelines on CT

				head/neck.

3.19. Shunt Series

Examination Type	Indication	Contraindications	Radiographic Projections	Notes
Shunt series (adult)	Assess location and integrity of ventriculoperitoneal shunt		• Lateral skull • Lateral cervical spine • PA/AP chest • AXR	Ensure overlap of projections so that entire shunt is visualised on radiographic series

4. References

Royal College of Radiologists (2017). iRefer: Making the best use of clinical radiology. RCR, May 2017.

Ionising Radiation (Medical Exposure) Regulations (2017). HMSO.

5. Clinical Audit Standards

Regular image quality audits are undertaken by the Quality Assurance Team, to assess Departmental image quality and ensure high standard are maintained. Rejection analysis is also undertaken monthly to assess clinical image standards.

Compliance with the process will be monitored through the following:

Key elements	Process for Monitoring	By Whom (Individual / group /committee)	Responsible Governance Committee /dept	Frequency of monitoring
Annual image quality audits	Review of image quality against defined criteria	Plain Film Audit Lead	Radiology Governance	Annually
Biannual update of SOP in line with iRefer guidelines	Biannual review	Plain Film Deputy Lead	Radiology Governance	Biannual

The audit results are to be discussed at radiology governance meetings to review the results and recommendations for further action.

6. Appendices

6.1. Appendix 1: Bone Age Hand & Wrist

Radiographic Technique:

Dorsi plantar view of **non-dominant** whole hand and wrist.

- If a follow-up attendance, ensure same wrist is imaged as last time.
- If the right hand/wrist is imaged, make a note on the RIS notepad of the reason for doing so, as well as annotating the image with “Non-dominant hand”.
- The tube is centred above the head of the 3rd metacarpal, at a tube-cassette distance of 115cm.
- Ensure that wrist, hand and fingers are in good contact with the plate i.e. the plane of the growth plate is perpendicular to the imaging plate. This improves accuracy of image interpretation.
- Include all of the phalanges and the epiphyseal growth plate of the distal radius.
- Ensure that fingers and thumb are straight with the middle finger in line with the radius and ulna.
- Thumb at 30 degrees to 1st finger.

6.2. Appendix 2: Ligamentous Instability

These projections will be requested by the Upper Limb Orthopaedic Consultants specifically to assess carpal ligamentous instability or scapho-lunate instability.

Undertake the following projections:

- AP (or DP) clenched fist in neutral position*
- DP with ulnar deviation non-clenched
- DP with radial deviation non-clenched (demonstrates triquetral-lunate widening)
- Lateral

*AP projection is preferable, as DP positions wrist in slight extension.

6.3. Appendix 3: Foot & Ankle Reconstructions

Requests from the lower limb Orthopaedic Consultants for pre- and post-reconstruction procedures (fusions, osteotomies, ankle replacements) should be

imaged in the following way:

Ankle

- AP and lateral - both **weight bearing**.

Hindfoot

- Triple arthrodesis / hind foot arthritis:
  - Lateral ankle weight bearing
  - DP foot weight bearing
  - Oblique foot
- Ankle fusion or pan-talar arthrodesis
  - AP and lateral ankle, both weight bearing
- Tibialis posterior tendinitis or similar hind foot problems:
  - AP and lateral weight bearing both feet.
- All new patients need an oblique in addition to the above.
- General default is AP and lateral weight bearing.

Forefoot

- New patients:
  - DP weight bearing both feet.
- For a required fusion they should have an additional lateral of the affected foot (weight bearing)
- Small toe problems and Morton`s neuroma do not require X-rays.

Pre-operative Images

- WB AP ankle
- WB lateral ankle (to include whole foot)
- WB DP foot
- Oblique foot

6.4. Appendix 4: Spatial Frame Protocol

Aim: to produce high quality images of the tibia & fibula so as to determine the level of deformity and amount of correction required for patients with a Taylor Spatial Frame.

Technique:

1. Patient should lay supine on the table.
2. Patient should be free of all artefacts, ie, shoes, socks etc..
3. Use long view cassette.
4. Position the cassette under the patient such that the bottom (labelled bottom on the back) is towards the ankle joint. The patient's leg should be positioned so that the leg is central lengthwise to the cassette.
5. The patient's leg should be positioned such that either the proximal, central or distal ring (as indicated on the request card) is superimposed. On the resultant image, the superimposed ring should appear as a single straight bar rather than ovoid in shape. If the ring is not specified, contact Orthopaedic Clinic to confirm.
6. The table should be lowered as much as possible and the tube height raised so as to include both the knee and ankle joints (if this is not possible using the table, consider sitting the patient on a chair and positioning the cassette and their leg on the low stool).
7. Centre and collimate to include the whole spatial frame, ankle and knee joints.
8. Do not collimate within the lateral borders of the frame, otherwise the software programme will not be able to determine how much correction is required.
9. To process the image:

a. Select the patient on the Fuji workstation

b. Name the middle portion of the cassette first, then the lower portion

c. Process the cassette (turning it around to process the lower section)

d. Annotate and stitch images together.

10. Turn patient towards affected side and repeat for the lateral projection.

6.5. Appendix 5: Orthoview Measurements

Pelvis

Aim: to provide measurements which will enable accurate pre-operative planning, for all potential joint replacements (THR).

The measurements of FFD (Focal-Film Distance) and FOD (Focus-Object Distance) should be taken on all patients referred from Orthopaedics over the age of 55. The referrer will indicate on the ICE request whether these measurements are required. Any other patients that require measurements outside of these criteria will be at the Consultant's request.

Using the relationship between FFD and FOD, the Orthopaedic Surgeons will be able to calculate the degree of magnification and therefore select the correctly sized prosthesis prior to surgery.

Technique:

1. Patient should be changed and all artefacts removed from the affected area.
2. To ensure accurate (and ease of) measurement, the patient needs to be positioned on the couch so that the affected hip is closest to the Operator.
3. Patient lies supine, with the ASIS equidistant to the cassette and the feet internally rotated.
4. Raise the table to working height.
5. Lower the X-ray tube to FFD of 115cm.
6. Centre and collimate as normal.
7. Using the X-ray tube table measure, measure the FOD to the greater trochanter of the affected side. If the trochanter cannot be located, measure to the midpoint of the depth of the patient.
8. Expose the patient as normal.
9. When the image has processed on the Fuji workstation, annotate the image with the FFD and FOD measurements; send the images to PACS.

Authors: AKH/HB (January 2010)

Knees

Aim: to provide measurements which will enable accurate pre-operative planning, for all potential joint replacements (TKR).

The measurements of FFD (Focal-Film Distance) and FOD (Focus-Object Distance) should be taken on all patients referred from Orthopaedics over the age of 55. The referrer will indicate on the ICE request whether these measurements are required. Any other patients that require measurements outside of these criteria will be at the Consultant's request.

Using the relationship between FFD and FOD, the Orthopaedic Surgeons will be able to calculate the degree of magnification and therefore select the correctly sized prosthesis prior to surgery.

Technique (AP Knee):

1. Patient should be changed and all artefacts removed from the affected area.
2. Patient stands in front of the 24x30 cassette in the true AP position.
3. Tube should be positioned at an FFD of 115cm.
4. Centre and collimate as normal.
5. Measure and record the distance to the lateral femoral condyle (FOD), ensuring that the tape measure is perpendicular to the cassette. If the femoral condyle cannot be located, measure to a point midway between the anterior and posterior aspects of the knee.
6. Expose the patient as normal.
7. When the image has processed on the Fuji workstation, annotate the image with the FFD and FOD measurements; send the images to PACS.

Technique (Lateral Knee):

1. Patient should be positioned in the lateral position on the X-ray table.
2. Raise the table to working height, and lower the tube such that the FFD is 115cm to the cassette (**Remember:** 115cm on the X-ray tube means it is 115cm to the bucky top, not the table top).
3. Centre and collimate as normal.
4. Measure to a point midway between the femoral condyles, 2cm above the superior border of the patella (FOD).
5. Expose the patient as normal.
6. When the image has processed on the Fuji workstation, annotate the image with the FFD and FOD measurements; send the images to PACS.

Authors: AKH/HB (January 2010)

6.6. Appendix 6: Leg Length Measurements

Justification

- Possible leg length discrepancy
- Visionairre Knee replacements
- Varus, Valgus deformity

Technique

- Place grid and cassettes against wall and lock wheels
- If child is very slim the grid may not need to be used
- Use the Longview cassette with the “top” section inserted.
- FFD: at least 180cms but may need to be increased if patient is very tall.
- Stick long ruler to centre of grid.
- Tape it on if patient unable to hold it in position
- Patient should stand in the AP position against imaging plate
- The patient will need to stand on a box in front of the grid to ensure ankle joints are within the area of interest
- Both patellae should face forward (true AP knees)
- Legs should be fully extended as much as possible
- Image full length of legs to demonstrate ankle joints and hip joints
- Area of interest to include iliac crests, ankle joints and lateral skin borders.
- Use foot blocks under shorter leg to even up leg length discrepancy (kept in G9 cupboard).
- Laterals are done separately, when required.
- Patient stands with affected leg against cassette in lateral position.
- Raise other foot up onto step in front of patient.
- Ensure patient is steady so use step with handle

Processing (IP registration)

- Select Patient
- Select leg length (ensure WS is highlighted)
- Register the 1st IP starting from the TOP
- 3 exposure menus will automatically be displayed.
- Register the 2nd(middle) IP then the 3rd(bottom)
- Place in reader in order: i.e. top, middle, bottom
- Insert the cassette that covers the thickest body part 1st.

Processing (Image stitching)

- Annotate individual images as required. On the bottom image include the height of the foot block used.
- Shutter image at top and bottom to include the crosses (but not side). Highlight the top image to be stitched, then click on image stitching icon: (bottom right hand corner on main page)
- Images must be in consecutive order.
- Shutter, window and re-annotate the image after stitching, as annotation is not saved.

Exposure Factors (Guidance only)

- **Adult male(12stone):** 50mAs, 90kv; 2m FFD; in grid
- **12 year old:** 10mAs, 81kV, 1.9m FFD; in grid
- **10year old:** 7mAS, 75kV, 1.8m; no grid

6.7. Appendix 7: Judet & Inlet/Outlet Projections

6.7.1. Judet Projections

Rationale: This protocol has been agreed with the chairman of the Trauma & Orthopaedic Directorate as the standard management for obtaining Judet views on patients with acetabular fractures, with the minimum of discomfort.

Criteria

1) Judet views may only be requested by a Consultant Orthopaedic Surgeon or Senior Registrar.
2) Judet views will only be done during the normal working day (09.00 – 17.00) including Saturday and Sunday when there are sufficient support staff (3-4 people).
3) Patients will normally require analgesia and this must be given on the ward before coming to the X-ray Department. Analgesia may take up to one hour to be effective.
4) Patients will be transferred flat onto an x-ray table with assistance from sufficient staff to enable a safe transfer with the minimum discomfort.
5) Judet views are not to be attempted portably or in theatre.
6) If the Radiographer or Assistant Practitioner is in doubt as to the necessity of an out of hours request she/he may in the first instance contact the Consultant Radiologist or Consultant Orthopaedic Surgeon.

Technique Guide

Note Pelvic ring fractures (excluding fractures purely of the superior and inferior pubic rami (require INLET and OUTLET views. See technique guide.

Procedure for Judet Projections:

1. Patient **must be transferred to an x-ray table**. It may be necessary for a member of the medical staff to be present to give appropriate analgesia.
2. Use 35 x 43 film to show whole of pelvis.
3. Perform an AP pelvis.
4. Raise patient 45° each side in turn and support with foam wedges (use large 45* foam pad)
5. **Centring with required side down**, centre over iliac fossa half way between ASIS and midline of pelvis (or 5cm medial to the ASIS) with straight tube.
6. **Centring with required side up,** centre 2.5cm behind ASIS of raised side with straight tube – shows posterior column of pelvis

6.7.2. Inlet & Outlet Views

Always perform an AP pelvis in addition to inlet & outlet projections.

Outlet View:

a.i.1. Use 35 x 43 film

a.i.2. Patient supine

a.i.3. Tube angled 30° cephalad

a.i.4. Centre over symphysis pubis to include whole of pelvis with an increased FFD to minimise distortion

a.i.5. To show top S1 body as a straight line

Inlet View:

a.i.5.a.i.1. Use 35 x 43 film

a.i.5.a.i.2. Patient supine

a.i.5.a.i.3. Tube angled 30° caudally

a.i.5.a.i.4. Centre 10cm above symphysis to include the whole of the pelvis on film

a.i.6. Increase FFD to minimise distortion

7. To show whole of pelvic ring, including SIJs

6.8. Appendix 8: Skeletal Survey (Adult)

For Paediatric skeletal survey protocol (NAI), see Paediatric Imaging Protocols (accessible on the intranet).

For Forensic skeletal survey protocol, see Forensics Policy (accessible on the intranet).

Indication: patients will be referred for skeletal surveys to query disease processes such as myeloma, metastases (often following nuclear medicine investigations) and metabolic bone disease.

Plain film Skeletal Survey should ONLY be undertaken where a patient is unable to have cross-sectional imaging, eg, body habitus, claustrophobia.

Projections:

- Lateral skull
- Chest
- Bilateral proximal AP humerus
- AP pelvis to include proximal femora
- Bilateral distal AP femora

- Lateral cervical spine
- Lateral thoracic spine
- Lateral lumbar spine

Requests can be vetted by any Senior General Radiographer. Be mindful that these examinations take some time and so will need a room booked for at least 30 minutes.

6.9. Appendix 9: Supplementary views

Stryker's View

AP with palm of hand on head and elbow pointing forwards. Angle the tube 15° cephalad. Centre through axilla to the coracoid process.

This projection is to demonstrate calcification.

Modified Axial Shoulder

Sit the patient on the trolley or with their back to the x-ray table/chest stand. Place the cassette at 45* behind the patient at the level of and in contact with the elbow on the affected side. Angle 30° posteriorly from the vertical and 15° laterally (increase angle if patient is kyphotic). Centre to the glenoid. As large an FFD as possible. Exposure factor guide: 70kVp & 10mAs.

This projection is used on patients with limited shoulder mobility.

Serendipity Projection

This projection is undertaken to demonstrate dislocation/subluxation of the sterno-clavicular joints (SCJ) and may be requested specifically by a Consultant Radiologist (discuss with appropriate Consultant). However, it is generally contraindicated and US is the recommended examination.

The patient lies supine on the table. Place the cassette directly under the patient's affected midline at the level of the SCJ. Angle the tube 30* cephalad, centring to the midline at the level of the SCJ. Collimate tightly to include both SCJ.

This examination is generally not justified, as ultrasound is the recommended examination to demonstrate the sternoclavicular joints.

Additional Ankle projections

- **Sub Talar projections:**
    - requested by Orthopaedic Surgeons
    - 2 x 45° obliques:

        Internal + 18° cranial angle

        External + 20/25° cranial angle
- **Stress views:**
    - performed under supervision of Orthopaedic Surgeon
    - Surgeon will require lead glove and lead coat.

6.10. Appendix 10: 10p Hip Templating

These projections are required by Mr Nolan (Orthopaedic Consultant Surgeon) prior to Birmingham hip resurfacing operations.

Patients requiring these images will be referred by Pre-assessment or the Surgical Day Unit.

A referral requesting 10p templating will be made on ICE with the relevant clinical information.

The patient will arrive in the Department with a 10 pence piece stuck on the side of their affected hip (do not undertake imaging if the patient has no 10p piece or attempt to stick on a 10p yourself).

Technique:

- Coned AP Hip (ASIS down) to include lateral skin edge (showing 10p piece).
- Lateral oblique hip with 10p removed.

NB: it is advisable to check the coned AP image prior to removing the 10p piece, in case of the need for a repeat.

Patients may have had recent templating images (eg, Orthoview measurements), but if requested for resurfacing hip patients, this protocol should still be followed.

Protocol agreed by Diki Raja (Plain Film Lead) – 18th May 2012.

6.11. Appendix 11: 10p Knee Templating

Patients requiring templating will be referred by the Pre-Assessment Clinic and will require a Unicompartmental Knee Replacement. Requests will specify that 10p templating is required in the clinical information.

The patient should attend X-ray with a 10p stuck on the medial side of the knee but not obstructing the articular surface of the femoral condyle.

Technique:
Lateral projection only.

Please ensure that skin edge is included on the lateral view to show the 10p coin.

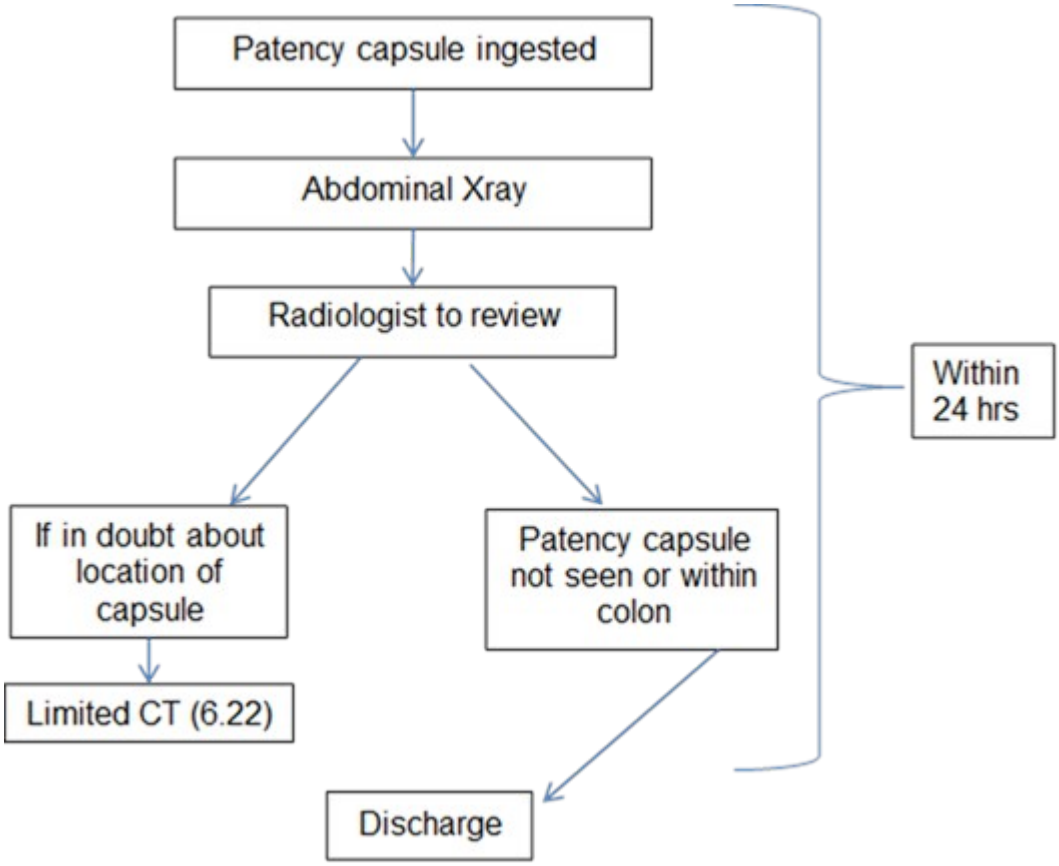
Protocol agreed by Diki Raja (Plain Film Lead) – 21st May 2013

6.12. Appendix 12: List of Common radio-opaque bones and other common foreign bodies

Highly Radio-opaque	Moderately Radio-opaque	Not radio-opaque
Salmon	Trout	Herring
Cod Mullet	Pomfret	Sardine
Sole	Plaice	Mackerel
Megrime	Scad	Sprat
Tilapio	Sword Fish	Hake
Haddock	Grey Mullet	Kipper
Bass Red Fish	Monk Fish	Bream
Durad	Red Snapper	Pike
Gurnard		Bullhead
Lemon Sole		Flander
Cole fish		Wood
Iron Tablets		Splinters
Any metal FB e.g. paper clips, ear-rings		Thorns
Batteries		Plastics
		Lego
		CD's / DVD's
		Fibre-glass

6.13. Appendix 13: Patency Capsule Pathway

Patency capsule checks can be variable in time. The patient should be aware when they need to be performed. Please show the radiographs to a Radiologist as a CT may be required.



7. Equality Impact Assessment (EIA)

Type of function or policy	Existing

Division	Clinical Support Services	**Department**	Radiology
Name of person completing form	Emma Key-Yeomans	**Date**	01/02/2024

Equality Area	**Potential Negative Impact**	**Impact Positive Impact**	**Which groups are affected**	**Full Impact Assessment Required YES/NO**
Race	None	None	N/a	No
Pregnancy & Maternity	None	None	N/a	No
Disability	None	None	N/a	No
Religion and beliefs	None	None	N/a	No
Sex	None	None	N/a	No
Gender reassignment	None	None	N/a	No
Sexual Orientation	None	None	N/a	No
Age	None	None	N/a	No
Marriage & Civil Partnership	None	None	N/a	No

EDS2 – How does this change impact the Equality and Diversity Strategic plan (contact HR or see EDS2 plan)?	

- **A full assessment will only be required if: The impact is potentially discriminatory under the general equality duty**
- **Any groups of patients/staff/visitors or communities could be potentially disadvantaged by the policy or function/service**
- **The policy or function/service is assessed to be of high significance**

IF IN DOUBT A FULL IMPACT ASSESSMENT FORM IS REQUIRED

The review of the existing policy re-affirms the rights of all groups and clarifies the individual, managerial and organisational responsibilities in line with statutory and best practice guidance.