

## GUIDELINES ON MAKING THE BEST USE OF A DEPARTMENT OF CLINICAL RADIOLOGY

### 1. INTRODUCTION

#### 1.1 Why are guidelines needed?

- The use of radiological investigation is an accepted part of medical practice justified in terms of clear clinical benefits to the patient
- A useful radiological investigation is one in which the result – positive or negative – will alter clinical management and/ or add confidence to the clinicians diagnosis. Such clinical benefits to the patient should far outweigh the small radiation risks from radiological investigations.
- However possible measures should be taken to avoid unnecessary exposure of patients to radiation. One important way of reducing the radiation dose is to avoid undertaking investigations unnecessarily (especially repeat examinations).
- A significant number of radiological investigations do not fulfill these aims and may add unnecessarily to patient irradiation. Continued use of recommendations of this kind leads to a reduction in the number of referrals for investigations and also to a reduction in medical radiation exposure.
- Nevertheless the primary objective of this booklet is to improve clinical practice. Such recommendations work if they are used in conjunction with clinico-radiological dialogue.

- For some clinical situations firm guidelines have been established by the Sri Lanka College of Radiologists.

Just as the term implies, a guideline is not a rigid constrain on clinical practice, but a concept of good practice against which the needs of the individual patient can be considered. They are not absolute rules. At the same time there have to be good reasons for ignoring them. No set of recommendation will commend universal support, and you should discuss problem with your radiologist.

- All examinations should be optimized to obtain maximum information with the minimum radiation. It is important to be aware of this, as the imaging performed may not be what the referring clinicians expects unless the radiologist is informed the exact clinical problem that has to be solved.

## 1.2 For whom are the guidelines designed

Guidelines are intended to be used by all “referrers” who provide health care including general practitioners. They are most useful to simulate good practice. The range of investigations available to different health professionals must be determined in consultation with local specialists in radiology bearing in mind the available resources.

## 1.3 How are the guidelines structured?

- a. An overview of radiological investigations available.
- b. Facts to be considered when requesting for a radiological investigation.
- c. Importance of Communicating with the department of clinical Radiology
- d. Pregnancy and protection of fetus
- e. Information with regard to radiation doses received from different radiological investigations

## PLAIN RADIOGRAPHY

Plain Radiography is available in almost all the hospitals in Sri Lanka.

Plain X rays are very useful but should be used only if clinically indicated. In certain clinical situations X ray changes appear late (e. g. Acute osteomyelitis). Views appropriate for the clinical problem should be carried out. Guide lines for radiographic projections are given below.

### Some Useful Plain Radiographic projections and information **GRADE X**

HIPS	AP & PELVIS LAT (frog leg position)
KNEE	AP & LAT TUNNEL VIEW (not a routine view) Demonstrates intercondylar area. SKYLINE VIEW OF PATELLA (not a routine view) for Chondromalacia/ Recurrent dislocation
ANKLE	AP & LAT
FEMUR	AP & LAT

TIB / FIB	AP / LAT
FOOT	AP & OBL
CALCANEUM	AP & AXIAL LAT. OF BOTH HEELS ONLY - For suspected calcaneal spur
TARSUS and TOES toe)	AP & LAT X-ray only the required

## UPPER LIMB

STERNO CLAVICULAR JOINT	OBLIQUE VIEWS OF EACH JOINT any further views check with radiologist
A.C JOINT	AP SHOULDER
CLAVICLE	AP / PA
SCAPULAR	AP & LAT
SHOULDER	AP & AXIAL
ELBOW	AP & LAT  LAT & AXIAL - Supracondylar # follow up

WRIST	AP & LATERAL
SCAPHOID	SCAPHOID VIEWS
HUMERUS	AP & LAT
FOREARM	PA & OBLIQUE
HANDS	PA
FINGER	AP & LAT

## BONE AGE IN CHILDREN

WRIST AND HAND of  
**non** – dominant  
hand  
Usually left (Useful from 3  
months of age to 18 years)

## SPINE / PELVIS

CERVICAL	AP & LAT (obliques not routinely indicated)
ATLANTO AXIAL JOINT	LAT AND AP (open mouth)
CERVICO THORACIC FOR C7/T1 junction REGION	SWIMMERS VIEW  view fails to show C7/T1

THORACIC	AP & LAT
LUMBAR routinely indicated.	AP & LAT (obliques not Demonstrates pars interarticularis defects)
SACRUM	AP with cranial angulation
COCCYX	LAT only
SI JOINTS	AP / PA (check with radiologist for further view).

## HEAD

SKULL gives more information than PA	LAT /PA Lateral view
FACIAL BONES	OM VIEW (Sinus view)
IAMS	PER ORBITAL VIEW
MANDIBLE	2 LATERAL OBLIQUES SUBMENTOVERTICAL (SMV) VIEW ORTHOPANTOMOGRAM – (OPT)

MASTOIDS	LAT OBLIQUES + TOWNES SLIT VIEW
NASAL BONES	LAT only
SINUSES	OM (Sinus View)

## SKELETAL SURVEY

SKELETAL SURVEY line of	should NOT be first
METASTASES & MYELOMA	investigation – check whether patient has had an isotope bone scan – may need specified films for confirmation. Skeletal metastases are generally visible in scintigraphy before appear on plain radiography.

Otherwise:

CHEST – If no  
previous within one  
week  
SKULL – LAT  
C / SPINE – LAT  
D / SPINE – LAT  
L / SPINE – LAT  
PELVIS AP

SKELETAL SURVEY FOR SHORT STATURE DYSMORPHIC SYNDROM	PA chest AP pelvis AP lumbar spine Lateral thoraco lumbar spine AP one upper limb and lower limb PA one hand Lateral skull to include atlas and axis.
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### SKELETAL SURVEY IN CHILD ABUSE (MORE USEFUL UNDER 2 YEARS OF AGE)

Age 0-2years, CT of head is mandatory to look for possible Subdural haemorrhage  
3-5 years, X ray only clinically suspicious areas  
Age > 3 years, survey is not generally indicated as these children can describe where the pain is located.

### Useful projections for skeletal survey

AP chest  
AP both upper limbs  
AP both lower limbs  
Pelvis  
Coned lateral of knees and ankles  
Lateral of thoracolumbar spine  
AP and lateral views of skull, Towne's view if occipital injury is suspected  
AP of hands and feet

## CHEST

Tele chest radiograph unless the patient cannot stand for the X-ray

Lateral view	Not a routine  Further views to be discussed with the radiologist
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RIBS	PA/OBLIQUES (Check with radiologist)
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STERNUM	LAT / OBLIQUES (Check with radiologist)
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CHILDREN	If the child can stand for the x ray an erect chest should be done
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CXR	<ul style="list-style-type: none"> <li>ROUTINE PREOPERATIVE – Not indicated in patients &lt;60 yrs undergoing non-cardiothoracic surgery. The yield of abnormalities increases in patients &gt;60 yrs. However, if patients without known Cardio-respiratory disease are excluded the yield is still low.</li> </ul>
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**GRADE X**

IN ASTHMA –patients presenting with asthma but without localizing signs in the chest, pyrexia or leucocytosis do not require chest x ray, except when asthma is life threatening or fails to respond to treatment.

- IN PNEUMONIA –the majority of patients with community acquired pneumonia will show radiological resolution at four weeks, but this may be prolonged in the elderly, smokers and those with chronic airway disease. Further CXR after resolution in asymptomatic patients is not indicated.
- IN PNEUMONIA FOLLOW UP – CXR need not be repeated before hospital discharge in those who have made a satisfactory clinical recovery from community acquired pneumonia. However CXR should be arranged in about 6 weeks if there are persistent signs and symptoms and who are in high risk category e.g. smokers and those > 50 years.

**KUB (Kidney Ureter Bladder) x ray**

Bowel preparation needed with a laxative such as dulcolax prior to X ray

**GRADE X****AXR (Abdominal X-ray)****INTESTINAL OBSTRUCTION/PERFORATION**

- Supine x ray may be sufficient to establish diagnosis of obstruction and point to an anatomical level.
- Consider erect x ray if supine one is inconclusive.
- Erect CXR is very useful to diagnose free air in the peritoneal cavity.

**GRADE X**

- Lateral decubitus abdominal X ray with the right side up is indicated for free air if the CXR has to be supine. Patient has to be in decubitus position for about 5-10 mins for the air to move to the most non dependant part in the abdomen. Therefore transfer the patient from the ward to the radiology department in lateral decubitus position with the right side up for the x ray

## ULTRA SOUND (US)

- Ultrasound does not have ionizing radiation and is relatively inexpensive and available in most of the hospitals.
- US is an excellent initial investigation for a wide range of clinical referrals. Referring clinicians therefore have a duty to consider carefully whether the results will affect management in order to prevent ultrasound departments being overloaded.
- Ultra sound scan is highly operator dependent and should be interpreted by a qualified person.
- US can be difficult and unsatisfactory in obese patients, and distribution of bowel gas may mask some features. Most of the bowel pathologies cannot be diagnosed by Ultrasound.

In general for abdominal scans patient has to be prepared depending on the clinical problem. **GRADE X**

1. For hepatobiliary pathology – Patient has to avoid fat free diet for 4 to 6 hours.
2. For genitor urinary and pelvic pathology – Patient has to be well hydrated and be with a full bladder.

3. No preparation is necessary for pregnancies after 2<sup>nd</sup> trimester, small parts examinations such as neonatal brain, neck, breast, limbs and scrotum.
4. When requesting for Doppler studies the region and the type (e.g. Arterial Doppler or Venous Doppler) has to be clearly specified. This is important as each study has different machine parameters).

## IMAGING USING CONTRAST MEDIA

- These are specialized investigation and generally, prior appointments have to be made with the radiology department. Advice should be obtained regarding the preparation. **GRADE X**
- Intravascular Contrast Media may carry a risk of reactions. Therefore for the prevention of such reactions following information has to be given on the request form for imaging: **GRADE X**
  1. Whether there has been a previous generalized contrast media reaction, either moderate (e.g. urticaria, bronchospasm, moderate hypotension) or Severe (e.g. convulsions, severe bronchospasm, pulmonary oedema, cardiovascular collapse).

2. Asthma
  3. Allergy requiring medical treatment
- Avoiding iodinated contrast medium induced nephrotoxicity.

Serum creatinine not older than 6 months should be provided with the imaging request at the time of referral for a contrast enhanced imaging examination of patients having:

- Renal disease
- Renal surgery
- Proteinuria
- Diabetes mellitus (especially if taking metformin)
- Hypertension
- Gout
- Intake of nephrotoxic drugs

## COMPUTED TOMOGRAPHY (CT)

**Guidelines for Spiral CT are available separately please refer them.**

CT is now available in almost all the provincial and in some base hospitals. There have been recent advances in CT due to the development of spiral and multislice scanners.

Like all radiological requests, any CT referral which falls outside established guidelines should be discussed with a radiologist in order to minimize the extent of the examination (and thereby cost and radiation dose.)

CT imparts a relatively high x – irradiation dose. Thus it is always worth considering alternatives, especially in view of the increasing role of MRI (GRADE Y)

It is helpful if the clinical notes and previous imaging investigations are available for review by the imaging department at the time of the proposed CT. **GRADE X**

A few further points

- CT remains the optimal investigation for many clinical problems within the chest and abdomen, despite the radiation risk.
- CT is still widely used for intracranial problems, especially cerebrovascular accidents.
- CT remains a simple method of staging many malignant diseases and of monitoring response to therapy.



- CT provides valuable pre-operative information about complex masses and is widely used to investigate post operative complications.
- CT allows accurate guidance for drainage procedures and biopsies.
- CT has an important role in the management of trauma.
- CT images may be degraded by prostheses, fixation devices etc.
- CT provides better anatomical detail than US in obese patients. In thinner patients and in children US should be used whenever possible.
- CT of the abdomen imparts a radiation dose equivalent to about 500 chest x rays.

## MAGNETIC REASONS IMAGING (MRI)

This is available only at NHSL, Teaching hospital Kandy, Sirimavo Bandaranaike Hospital Peradeniya and Teaching Hospital Karapitiya of government sector and in some private hospital at present.

- MRI does not use ionizing radiation.
- MRI is in danger of being subjected to inappropriate demands, which may lead to long waiting times.
- Thus, all requests for MRI should be agreed with a radiologist.
- The imaging facility is expensive, not freely available in Sri Lanka and is time consuming.
- MRI usually provides more information than CT about intracranial, head and neck, spinal, and musculoskeletal disorders because of its high contrast resolution

Major recent advanced include. **GRADE Z**

- Breast and cardiac MRI.
- Angiographic and interventional techniques.
- Magnetic resonance cholangiopancreatography (MRCP) and
- Other fluid sensitive MRI techniques.
- Functional MRI imaging of brain.
- MRI is not approved in the first trimester of pregnancy. **GRADE X**

There are some definite contraindications to the use of MRI: **GRADE X**

Metallic foreign bodies (FBs) in the orbits, aneurysm clips, pacemakers, cochlea implants etc. Any uncertainty about contraindications should be discussed with the imaging department before an appointment is obtained.

## NUCLEAR MEDICINE (NM)

NM is valuable in view of the functional data it provides. Radiation doses imparted by most NM techniques compare favorably with those of many other imaging techniques using radiation.

The referring clinician should indicate the precise clinical problem requiring investigation in order to undertake the appropriate NM technique and the isotope for a given clinical situations.

Positron Emission Tomography combined with CT; PET/CT has recently made an impact in medical imaging.

PET/CT can identify small foci of viable tumours, and offers exceptional opportunities in the staging of various cancers (e.g. bronchus) and in cancer follow up (e.g. lymphoma) where other imaging techniques may be unable to distinguish between residual fibrotic masses and active disease.

- PET can provide unique data about brain metabolism and myocardial viability.

- Over the next few years there will be an increasing uptake of PET-CT into clinical practice based on recommendations by departments of imaging.

**PET/CT is still not available in Sri Lanka**

## INTERVENTIONAL RADIOLOGY (INCLUDING ANGIOGRAPHY AND MINIMAL ACCESS THERAPY)

This area of radiology is now fully established and new techniques are constantly developing. The precise arrangement for procedures varies considerably according to local expertise and availability of equipment. Requests for all such need detailed discussion involving various specialists.

Guidelines have been formulated by the Sri Lanka College of Radiologists for Vascular, hepatobiliary and renal interventions

### 1.11 Facts to be considered when requesting for a Radiological investigation **Grade X**

Considering the following would result in the reduction in the number of referrals for investigations and also to a reduction in medical radiation exposure.

- a). DO I NEED IT?  
Anticipated “positive” findings is usually irrelevant, or positive findings unlikely that investigating is unlikely to affect patient management.
- b). HAS IT BEEN DONE ALREADY?  
Every attempt should be made to get information and images of radiological investigations already done elsewhere.
- c). DO I NEED IT NOW?  
Investigating too early before the disease could have progressed or too often before the disease could have resolved so that the results are unlikely to influence treatment.
- d). IS THIS THE BEST INVESTIGATION?  
Doing the wrong investigation. Imaging technique are developing rapidly. If there is a doubt about the benefit of an investigation it is often helpful to discuss with a specialist in clinical radiology or Nuclear medicine before it is requested.
- e). HAVE I EXPLAINED THE CLINICAL PROBLEM TO THE RADIOLOGIST ADEQUATELY?

Failing to provide appropriate clinical information and questions that the imaging investigation should answer could lead to the wrong technique being used or the omission of an essential view that is crucial for the diagnosis.

- f). ARE TOO MANY INVESTIGATIONS BEING PERFORMED?  
Some clinicians tend to rely on more investigations than the others. Some patients take comfort in being investigated. Over investigation to satisfy yourself or the patient should be avoided.

### 1.12 Pregnancy and Protection of the fetus

**(Grade X)**

Investigation of a fetus using ionizing radiation should be avoided whenever possible. The prime responsibility for identifying such patient lies with the referring clinicians. Women of reproductive age presenting for an examination that will give radiation to the pelvic areas should be asked whether they are or may be pregnant, if pregnancy cannot be excluded whether period is overdue.

- 1) If no possibility of pregnancy, can proceed.
- 2) If definitely or possibly pregnancy (i.e. menstrual period is overdue) justification for the examination has to be revised by the radiologist and the referring clinician.

### 1.12 Importance of Communicating with the department of clinical Radiology

(Grade x)

Request forms for radiological investigations should be completed accurately and legibly in order to avoid any misinterpretation. State clearly the reasons for the request and give sufficient clinical details to enable the radiologist to understand the particular diagnostic or clinical problems that need to be resolved by the radiological investigation. If in doubt whether the investigation being requested is suitable or not, the problem should be discussed with an appropriate radiologist.

### 1.13 Radiation doses from common diagnostic radiology procedures are shown in the following table and radiation doses from different procedures are given as an equivalent to the number of chest x rays in order to be aware of exposure to radiation from such procedures.

(Grade x)

Typical effective doses from diagnostic medical exposures  
(mSv-millisiverts)

Diagnostic Procedure	Typical effective dose (mSv)	Equiv. no. of chest x-rays
<b>Radiographic examinations:</b>	<0.01	<0.5
Limbs and joints (except hip)	0.02	1
Chest (single PA film)	0.6	3
Skull	0.7	35
Thoracic spine	1.0	50
Lumbar spine	0.4	20
Hip	0.7	35
Pelvis	0.7	35
Abdomen	2.4	120
IVU	1.5	75
Barium Swallow	2.6	130
Barium meal	3.0	150
Barium follow-through	7.2	360
Barium enema	2.0	100
CT head	8	400
CT chest	10	500
CT abdomen or pelvis		

Diagnostic Procedure	Typical effective dose(mSv)	Equiv. no. of chest x-rays
<b>Nuclear Imaging studies:</b>		
Lung ventilation (Xe-133)	0.3	
Lung perfusion (Tc-99m)	1	
Kidney (Tc-99m)	1	
Thyroid (Tc-99m)	1	
Bone (Tc-99m)	4	
Dynamic cardiac (Tc-99m)	6	
PET head (F-18-FDG)	5	

**Band classification of the typical effective doses of ionising radiation from common imaging procedures.**

Band Examples	Typical effective dose (mSv)
0	US, MRI
I	CXR, XR, limb, XR pelvis
II	IVU, XR lumbar spine, NM (e.g. skeletal scintigram) CT head & neck
III	CT chest or abdomen, NM (e.g. cardiac)
IV	Extensive CT studies, some NM studies (e.g. some PET)

**References:**

- 1 Making the best use of a Department of Clinical Radiology; Guidelines for Doctors; The Royal College of Radiologists, UK; Fourth Edition 1998
2. Making the best use of a Department of Clinical Radiology; Guidelines for Doctors; The Royal College of Radiologists, UK; Fifth Edition 2003
3. Guidelines on Contrast Media By European Society of Urogenital Radiology; Version 5, January 2006
4. Diagnostic Radiology, A Textbook of Medical Imaging, by Granger and Allison, 4th Edition, 2002
5. A Textbook of Radiology and Imaging by David Sutton, 7th Edition, 2003