East Lancashire Hospitals NHS Trust
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Clinical Radiology Referral Guidelines

Urology, Adrenal and Genitourinary Referrals

Safe | Personal | Effective

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EAST LANCASHIRE HOSPITALS NHS TRUST

CLINICAL RADIOLOGY REFERRAL GUIDELINES

These guidelines are intended to be used by all "referrers" requesting imaging at East Lancashire Hospitals NHS Trust. They are appropriate for both primary and secondary care clinicians and Non-Medical Referrers (NMR) to promote the best use of imaging and resources for the benefit of our patients.

The Ionising Radiation (Medical Exposure) Regulations (IR(ME)R) provide for the health protection of individuals undergoing medical exposures involving ionising radiation. All diagnostic tests should therefore be carefully considered prior to referral and should only be requested appropriately. Diagnostic tests which do not utilise Ionising Radiation (such as ultrasound and magnetic resonance imaging) carry their own potential risks and as such are as strictly governed in terms of justification. This not only serves to protect patients, but also to manage demand appropriately and keep waiting times to a minimum.

The aim for all examinations should be to obtain the maximum information with the minimum of radiation. This means that on occasions the imaging undertaken may not be what the referring clinician/NMR expects. Radiology has set examination protocols utilised for the legal authorisation and justification of requests.

Optimising radiation dose

The use of radiological investigations is an accepted part of medical practice justified in terms of clear clinical benefits to the patient, which should far outweigh the small radiation risks. However, even small radiation doses are not entirely without risk. A small fraction of the generic mutations and malignant diseases that occur in the population can be attributed to natural background radiation. Diagnostic medical exposures account for one-sixth of the total population dose.

The Ionising Radiation (Medical Exposure) Regulations (IR(ME)2017 require that the unnecessary exposure of patients to radiation is kept to a minimum and ELHT must comply with these regulations. This is achieved by avoiding undertaking investigations unnecessarily (especially repeat examinations) and the use of dose optimisation utilising locally set diagnostic reference levels (DRLs).

The effective dose for a radiological investigation is the weighted sum of the doses to a number of body tissues, where the weighting factor for each tissue depends on its relative sensitivity to radiation-induced cancer of severe hereditary effects. This provides a single dose estimate related to the total radiation risk, no matter how the radiation dose is distributed around the body (Table 1).

Typical effective doses for some common diagnostic radiology procedures range over a factor of about 1,000 from the equivalent 1-2 days of natural background radiation.

Table 1

Typical effective doses from diagnostic medical exposure			
Diagnostic Procedure	**Typical effective dose (mSv)**	**Equivalent number of chest x-rays**	**Approximate equivalent period of natural background radiation**
Radiographic examinations			
Limbs & joints (except hip)	<0.01	<0.5	<1.5 days
Chest (single PA film)	0.02	1	3 days
Skull	0.06	3	9 days
Thoracic spine	0.7	35	4 months
Lumbar spine	1.0	50	5 months
Hip	0.4	20	2 months
Pelvis	0.7	35	4 months
Abdomen	0.7	35	4 months
Barium swallow	1.5	75	8 months
Barium meal	2.6	130	15 months
Barium follow-through	3	150	16 months
Barium enema	7.2	360	3.2 years
CT Head	2	100	10 months
CT Chest	8	400	3.6 years
CT abdomen or pelvis	10	500	4.5 years
Radionuclide Studies			
Lung ventilation (Xe-133)	0.3	15	7 weeks
Lung perfusion (Tc-99m)	1	50	6 months
Kidney (Tc-99m)	1	5	6 months
Thyroid (Tc-99m)	1	50	6 months
Bone (Tc-99m)	4	200	1.8 years
Dynamic cardiac (Tc-99m)	6	300	2.7 years
PET head (F-18 FDG)	5	250	2.3 years
*UK average background radiation = 2.2 mSv per year: regional averages 1.5-7.5 mSv per year			

Please note that the doses from some CT examinations are particularly high and the demand for CT imaging continues to rise. **It is therefore particularly important that referrals for CT are thoroughly justified and that techniques that minimise dose while retaining essential diagnostic information are adopted.**

In these referral guidelines, the doses are grouped to support the referrer in understanding the order of magnitude of radiation doses of the various investigations (Table 2).

Table 2
Typical effective doses of ionising radiation from common imaging procedures

Symbol	Typical effective dose (mSv)	Examples
None	0	Ultrasound (US), Magnetic Resonance Imaging (MRI)
☢	<1	Chest, limbs & pelvis X-ray, mammography
☢ ☢	1-5	Lumbar spine X-ray, Nuclear Medicine (NM) (e.g., bone), Computed tomography (CT) head and neck
☢ ☢ ☢	5-10	CT chest or abdomen, NM (e.g., cardiac)
☢ ☢ ☢ ☢	>10	Extensive CT studies, some NM studies (e.g., some Position Emission Tomography co-registered with CT (PET-CT)
The average annual background dose in most parts of Europe falls within the 1-5 mSv range ☢ ☢		

Pregnancy and Protection of the foetus

Irradiation of a foetus should be avoided whenever possible. This includes situations in which the woman herself does not suspect pregnancy. The prime responsibility for identifying such patients lies with the referring clinician. Radiology also checks the pregnancy status of patients when they attend for examination.

Persons of childbearing potential presenting for an examination in which the primary beam irradiates the pelvic area (essentially, any ionising irradiation between the diaphragm and the knees), directly or by scatter, or for a procedure involving radioactive isotopes, will be asked whether they are or may be pregnant.

If the patient can exclude the possibility of pregnancy, the examination can proceed. If the patient is definitely pregnant, or if pregnancy cannot be excluded, the justification for the proposed examination should be reviewed by the radiologist and the referring clinician/NMR, with a decision taken on whether to defer the investigation until after delivery. However, a procedure of clinical benefit to the parent may also be of indirect benefit to the unborn child and a delay in an essential procedure may increase the risk to the foetus as well as the parent. This consideration is especially relevant in an emergency situation and all decisions must be documented.

Guidelines Key

The pages of each section are composed five columns:

Clinical/diagnostic problem	Situation for requesting an examination
Investigation	Possible imaging techniques
Dose	Level of exposure to radiation ☢
Recommendation	Recommendation on appropriateness of the investigation
Comment	Explanatory notes

Urological, Adrenal & Genitourinary

Clinical/diagnostic problem	Investigation	Dose	Recommendation [Grade]	Comment
Hypertension in the young adult or in patients unresponsive to medication	MRA	None	Specialised investigation	MRA is the best non-invasive method to visualise the main renal arteries directly (Some MR contrast agents are contraindicated in patients with renal failure).
	US	None	Specialised investigation	Doppler US can be sensitive and specific but needs time and special expertise to evaluate the main renal artery.
	CTA	☢☢☢	Specialised investigation	CTA is as sensitive as MRA but more invasive (iodinated contrast renal artery irradiation) and should only be used if MRA is not available. CTA is not recommended patients with renal impairment
	DSA Angiography	☢☢☢	Specialised investigation	DSA angiography is used to show stenosis if surgery or angioplasty is considered as a possible treatment. Pressure measurement across the renal artery stenosis is important to assess the functional significant stenosis.
Renal failure	US	None	Indicated	US is indicated as the first investigation in renal failure to measure kidney size and parenchymal thickness and to heck for pelvicalyceal dilatation indicating possible obstruction. US may also be used to guide renal biopsy when histological diagnosis is required.
	AXR	☢	Indicated	AXR may be required to show calculi not detectable by US.
	NM-MAG3 or DMSA	☢☢	Indicated only in specific circumstances	NM may be used to assess functional drainage secondary to pelviureteric junction obstruction or relative renal function in renal failure.
	MRI	None	Specialised investigation	MRI is a possible alternative to contrast enhanced CT, but some MR contrast agents are contraindicated in patients with renal failure.
	CT	☢☢☢	Indicated only in specific circumstances	CT (unenhanced or enhanced, depending on renal function) helps if US is non-diagnostic or does not show the cause of obstruction.

				Unenhanced CT is the optimum investigation for characterisation of obstruction caused by calculi.
Measurement of renal function.	NM	☢ ☢	Indicated	Tc-99m DMSA is the most accurate method for the measurement of relative renal function; Tc99m MAG3 study is usually a satisfactory alternative except in patients with severely impaired renal function.
Suspected ureteric colic.	CT	☢ ☢ ☢	Indicated	MDCT is the most accurate investigation in suspected ureteric colic and a low radiation dose CT technique should be used.
	US AXR	None ☢	Indicated only in specific circumstances	Combination of US and AXR may be used when CT is not indicated – e.g., in pregnancy. US is less accurate than CT.
	MRU	None	Indicated only in specific circumstances	MRU may be considered as a problem-solving tool in pregnant women with suspected ureteric colic and evidence of hydronephrosis.
Renal calculi in absence of acute colic	AXR CT	☢ ☢ ☢	Indicated	AXR or unenhanced CT provides the best baseline assessment in patients with renal stone disease. In routine practice AXR is adequate to detect the majority of renal calculi, unenhanced CT is more sensitive. Follow-up examination depends upon the initial investigation for renal calculi detection. It is best to use the same investigation for follow-up.
	US	None	Indicated only in specific circumstances	US is less sensitive than unenhanced CT for the detection of renal calculi. Both unenhanced CT and US can detect calculi.
Renal Mass	US	None	Indicated	US is as sensitive at detecting renal masses >2cm and accurately characterises masses as cystic or solid. US helps to characterise some masses indeterminate at CT
	CT	☢ ☢ ☢	Indicated	CT is sensitive at detecting renal masses of 1-1.5cm or greater and accurately characterises most masses
	MRI	None	Specialised investigation	MRI (including contrast-enhanced imaging) is as sensitive as contrast-enhanced CT for the detection of and characterisation of renal masses. MRI should be used if masses are not adequately characterised by CT

				and US or if iodinated contrast medium is contraindicated because of diminished renal function or previous reaction.
Urinary tract obstruction: Diagnosis and causes.	US	None	Indicated	US can be used to assess the degree of collecting system dilatation (not always due to obstruction), the Doppler spectral pattern of intrarenal blood flow, the bladder, and the presence of ureteric jets.
	CT	☢ ☢ ☢	Indicated	Unenhanced CT is the investigation of choice in suspected ureteric coli. Contrast-enhanced CT with excretory phase (CT urogram) is useful in determining both the intrinsic and extrinsic cause of urinary tract obstruction.
	NM	☢ ☢	Indicated	Tc-99m-MAG3 with frusemide diuresis is used. Output (outflow) efficiency study provides reliable quantification of frusemide response independent of renal function. Parenchymal transit time index measurements aid assessment of obstructive nephropathy
Urinary tract infection in adults	US AXR	None ☢	Indicated only in specific circumstances	Most adults with urinary tract infection (UTI) do not require imaging. Imaging is indicated: ▪ In 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.
	CT	☢ ☢ ☢	Specialised investigation	US and AXR offer a good first investigation. Contrast enhanced CT may be necessary in severe infection not responsive to treatment, since CT detects small calculi, renal sepsis, and changes of pyelonephritis more sensitively than US.
Renal transplant dysfunction	US + Doppler studies	None	Indicated	US is useful in the detection of hydronephrosis, collections and assessment of perfusion. Colour Doppler US is helpful in the diagnosis of transplant artery stenosis. Doppler US cannot differentiate acute injection from acute tubular necrosis and biopsy may be required.
	NM	☢ ☢	Indicated only in specific circumstances	Tc-99m-MAG3 is useful to determine whether collecting system dilatation seen on US is obstructive and can usually distinguish between acute rejection and ATN in the early postoperative period.

	MR + MRA	None	Indicated only in specific circumstances	MRA is helpful in the diagnosis of transplant artery stenosis if colour Doppler US is equivocal or non-diagnostic. Some MR contrast agents are contraindicated in patients with renal failure.
Urinary retention	US	None	Indicated	Renal US is indicated to check for upper track dilatation (after catherisation to relieve bladder distention).
Prostatism	US	None	Indicated	Bladder US (with measurement of post-void residual volume and urine flow rate) is indicated in prostatism. Renal US is indicated if there is a post-void residue, haematuria, raised serum creatinine or infection.
Scrotal mass or pain	US	None	Indicated	US in indicated for scrotal swelling and when presumed inflammatory scrotal pain does not respond to treatment. Allows differentiation of testicular from extra testicular lesions.
Suspected testicular torsion.	US	None	Indicated	Frequently a clinical diagnosis. Urgent management is essential, and imaging should not delay intervention when appropriate. Colour Doppler US has a high sensitivity in suspected testicular torsion but there are still false negative results. US should be reserved for clinically equivocal cases. Intermittent torsion remains a significant diagnostic problem.
Suspected functioning adrenal medullary tumour.	US	None	Indicated only in specific circumstances	US may sometimes identify an incidental adrenal tumour and may be helpful in children but CT/MRI will always be required in patients with abnormal biochemistry who are candidates for surgery.
	CT MRI	☢ ☢ ☢ None	Specialised investigation	CT and MRI provide the best anatomical delineation of the adrenal tumour. It may be used to differentiate benign from malignant tumour and to detect the presence of adrenal tumour in patient with abnormal biochemistry. Imaging is rarely indicated in the absence of biochemical evidence of such tumours.
	NM-mIBG, SRS or PET-CT	☢ ☢ ☢	Indicated only in specific circumstances	Both mIBG and SRS can locate functioning tumours and are especially useful with ectopic or metastatic lesions. PET-CT may be considered if initial imaging is inconclusive.
Adrenal cortical lesions: Cushing's syndrome	CT MRI	☢ ☢ ☢ None	Specialised investigation	Local advice on the most appropriate examination should be sought. CT/MRI may be able to identify an adrenal cause for Cushing's syndrome. However, nodular adrenal hyperplasia can occur in a significant proportion of patients with ACTH-dependent and ACTH-

				independent Cushing's syndrome. In such a situation CT may be unable to distinguish adrenal adenoma and nodule hyperplasia
Adrenal cortical lesions: primary hyperaldosteronism (Conn's syndrome)	CT MRI	☢ ☢ ☢ None	Specialised investigation	Both CT and MRI can distinguish between a unilateral adrenal adenoma and bilateral adrenal hyperplasia. Local advice on the most appropriate examination should be sought.
	Adrenal venous sampling	☢ ☢ ☢	Indicated only in specific circumstances	Adrenal venous sampling may be required where other imaging techniques are inconclusive. Patients being considered for adrenalectomy or those that do not respond to medical management for CT/MRI diagnosed bilateral adrenal hyperplasia may be considered for adrenal venous sampling.
Testicular microlithiasis	US	None	Indicated only in specific circumstances	The yield for detection of testicular tumour in the presence of asymptomatic microlithiasis is low. Although there is no evidence to support the causal nature of such tumours, the incident of tumour is higher in symptomatic patients with microlithiasis compared with those without.
Screening of patients with Von Hippel-Lindau disease for renal manifestations	US	None	Indicated	US is a good investigation for screening this cohort of patients for any abnormality in the kidneys such as cysts or tumours. It will not reliably detect lesions <2-3cm in size.
	MRI	None	Indicated only in specific circumstances	MRI (including contrast-enhanced studies) can be used to characterise the abnormal cysts/tumours. It offers a radiation-free investigation to monitor the changes in the kidneys and should be used in preference to CT for long-term follow up.
	CT	☢ ☢ ☢	Indicated only in specific circumstances	CT is required to stage the patient in the presence of tumour or to characterise the renal abnormality if MRI is equivocal, contraindicated, or unavailable.
Male infertility	Scrotal and transrectal US	None	Indicated	Scrotal US is used to measure testicular volume, to assess testicular texture, detect varicoceles, and exclude testicular pathology. Transrectal US is used to detect any causes of mechanical obstruction involving the seminal vesicles, ejaculatory ducts, or vas deferens.
	MRI	None	Indicated only in specific circumstances	MRI may clarify transrectal US findings in specific cases.

Incidentally detected non-functioning adrenal mass	CT MRI	☢ ☢ ☢ None	Indicated	Management of an incidentally detected adrenal mass depends on the clinical setting. Biochemical evaluation is advised if clinically indicated since few incidental lesions will show secretory activity on biochemical screening. Small non-functioning lesions are mostly benign and most of them can be characterised by CT or MRI. They are then usually followed up with CT or MRI at intervals for 1-2 years although there is no agreement as to the frequency and duration of follow-up. In patient with large lesions and in those with known primary malignancy, guided biopsy or PET-CT may be considered to distinguish benign from malignant lesions.
	PET-CT	☢ ☢ ☢	Indicated only in specific circumstances	
	US	None	Not indicated	
Microscopic haematuria	US AXR	None ☢	Indicated	For young patients (aged <45) with microscopic haematuria only US and AXR may be used to assess the upper tracts; this strategy misses some upper tract lesions, including some calculi.
Macroscopic Haematuria	US AXR/cystoscopy	None ☢	Indicated	For young patients (aged <45), US and AXR are recommended first, in view of the lower radiation dose and offering the detection of renal mass lesions. Cystoscopy is advised. US may detect many bladder tumours but is not sufficiently sensitive to obviate cystoscopy.
	CT angiography	☢ ☢ ☢	Indicated	CT urography is the best test for detecting renal calculi, renal masses, and upper tract urothelial tumour. However, this is at the expense of higher radiation dose and should be considered when other tests (US and AXR and retrograde studies) are negative for high-risk patients and older patients (age >45).
	MRU	None	Specialised investigation	MRU may be considered as a problem-solving tool when patients present with hydronephrosis and iodine contrast allergy or renal failure. It is not a validated test for non-dilated upper tracts.