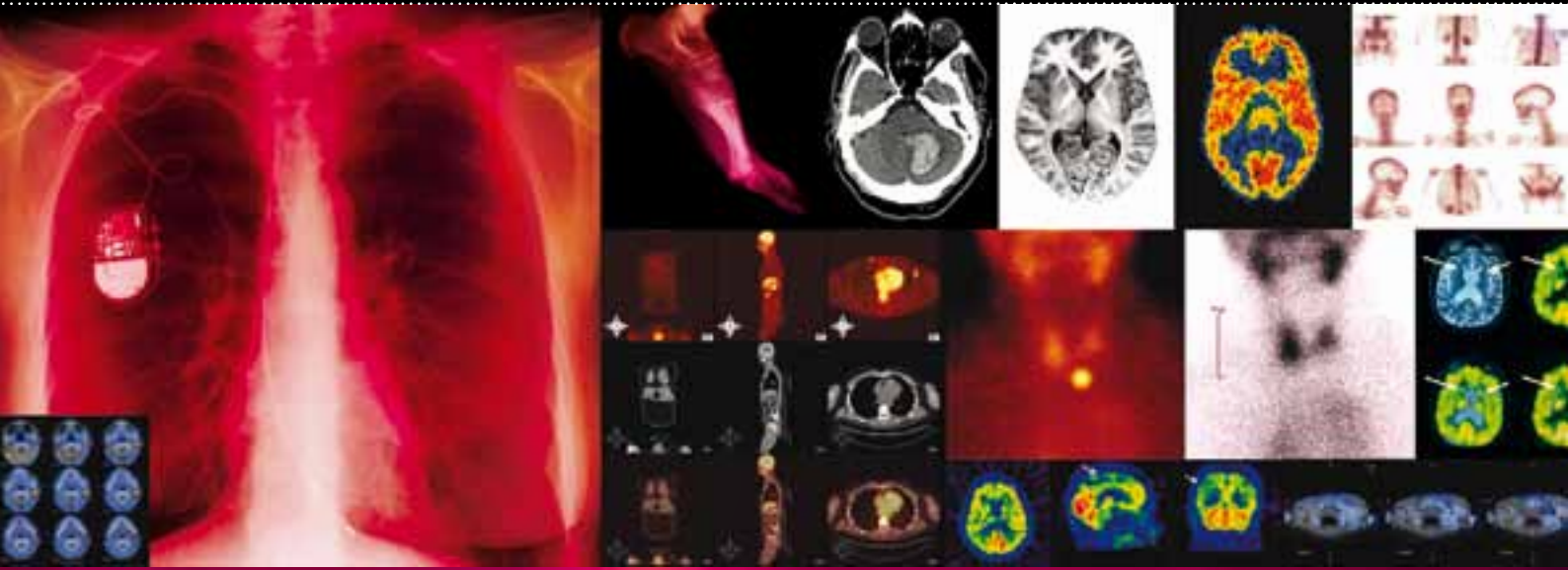
Referrer's Guide to Nuclear Medicine & PET Procedures



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REFERRER'S GUIDE TO NUCLEAR MEDICINE PROCEDURES INCLUDING POSITRON EMISSION TOMOGRAPHY (PET) PROCEDURES

This information has been prepared by the Australian and New Zealand Association of Physicians in Nuclear Medicine (ANZAPNM) to:
(a) outline the applications of the more commonly performed nuclear medicine and PET procedures,
(b) assist referrers in requesting the most appropriate procedure for a given patient, or
(c) use as a basis for discussion with the nuclear medicine specialist to whom you refer.

For any further information about nuclear medicine and PET scans, other clinical problems and less commonly performed procedures, please contact your nuclear medicine specialist colleague.

For more information about nuclear medicine including PET, see the ANZAPNM website at www.anzapnm.org.au.

NUCLEAR MEDICINE PROCEDURES

Referral forms may use different terminology for procedures. For example, myocardial perfusion scans are also known as myocardial perfusion stress tests or sometimes listed according to the radiopharmaceutical used (e.g. MIBI, Myoview or Thallium scans). If the procedure you'd like to request seems not to be listed, describe the clinical indication(s) and region of the body that you're interested in and the nuclear medicine specialist will decide the most appropriate scan to undertake in discussion with you.

Times allowed and preparations are intended as a guide only to assist you and your patients when organising appointment times for scans. Please note that approximate time is time from administration of radiopharmaceutical to the end of scanning. For many procedures there is a gap of an hour or more between administration of radiopharmaceutical and scan when patients may be able to go away.

This information is designed as a reference source for medical practitioners and is intended to supplement not replace particular patient information provided by individual nuclear medicine services. Your patients should ask the nuclear medicine service to which they are referred for specific information relevant to their procedure. All nuclear medicine services will have information leaflets and the ANZAPNM has produced a general patient information leaflet on nuclear medicine scans. This leaflet is also available online at www.anzapnm.org.au.

Please note that many procedures will be performed in conjunction with a low-dose CT scan for attenuation correction and anatomical localisation. This CT scan will take about 10 minutes.

CLINICAL INDICATION	PROCEDURE TO REQUEST	PATIENT PREPARATION	APPROXIMATE TIME
Bone scanning			
Evaluate bony pathologies such as: • bone tumours - primary and secondary • arthritis • osteomyelitis/ infection of the bone • metabolic bone diseases such as Paget's disease • sports injuries • stress fractures, • suspected fractures with normal x-ray • avascular necrosis	Bone scan - whole body or localised	No patient preparation Patients may be asked to drink 3 to 4 glasses of fluid after injection of radiotracer.	Up to 5 hours
Brain/neurological disorders			
Detection and evaluation of cerebral disease including: • dementia • localisation of epileptic foci • brain tumours including suspected recurrence • stroke • suspected brain trauma and brain death • assess cerebral flow reserve	Brain scan (with or without Diamox provocation)	No patient preparation	Up to 1½ hours For some conditions, the scan may be repeated on another day.
CSF studies for: • assessing ventriculo-peritoneal or atrial shunt patency	CSF shunt study	The area around the shunt reservoir may be shaved	2-24 hours
• CSF leaks	CSF leak study	No patient preparation	2-24 hours
• Hydrocephalus	CSF flow study	The lumbar puncture site will be prepared according to the standard approach.	Up to 48 hours

CLINICAL INDICATION	PROCEDURE TO REQUEST	PATIENT PREPARATION	APPROXIMATE TIME
Cardiac			
Myocardial viability - mostly used where a decision needs to be made as to whether cardiac surgery will provide significant benefit or not	Myocardial viability scan	Nothing to eat or drink (other than water) for 4-6 hours before test	Up to 5 hours A further scan may be performed on the following day - 1-1½ hours.
Assess cardiac size and function e.g.: • in coronary artery disease • cardiomyopathy • before and after chemotherapy	Gated blood pool scan	No patient preparation	1½ hours
Assess myocardial perfusion: • for diagnosis of coronary artery disease and risk stratification • for efficacy post revascularisation (surgical or percutaneous) • for preoperative assessment of patients at risk of ischaemia/ myocardial infarction • in the presence of unexplained arrhythmia Functional studies: Assess significance of: • known coronary artery disease not requiring immediate revascularisation • possible stenotic lesions post revascularisation (surgical or percutaneous) • lesions detected on CT coronary angiography	Myocardial perfusion scan or functional imaging	No products containing caffeine for 24-48 hours before test Nothing to eat or drink (other than water) for 4-6 hours before test Diabetics should contact the nuclear medicine service for special instructions. In consultation with referring doctor, nitrates, beta blockers, calcium antagonists and some erectile dysfunction agents (sildenafil [Viagra], tadalafil [Cialis], vardenafil [Levitra]) may be stopped for 2-3 days before test. Wear comfortable clothing and footwear as patient may need to exercise on a treadmill or stationary bicycle. (Patients unable to exercise will have a pharmacological stress test using persantin, dobutamine or adenosine.)	Up to 5 hours if done on a 1-day protocol If a 2-day protocol, the initial study may only take 2-3 hours. The patient may be called back on the following day for the second part - 1-1½ hours.

CLINICAL INDICATION	PROCEDURE TO REQUEST	PATIENT PREPARATION	APPROXIMATE TIME
Assess size and location of recent myocardial infarct	Myocardial infarct scan	Performed 2-8 days after an infarct No patient preparation	3-4 hours
Ventricular and atrial septal defects, patent ductus arteriosus (PDA)	(Qp:Qs) cardiac shunt scan	No patient preparation	1-1½ hours
Gall Bladder/Biliary			
Assess biliary tract function including: • acute and chronic cholecystis • common bile duct obstruction • gall bladder ejection fraction • post-cholecystectomy syndrome	Biliary (function) scan with or without CCK or morphine	Nothing to eat or drink (other than water) for 6-8 hours before test	1-1½ hours Some patients may require a second injection and further scan - allow total of 2½ -3 hours
Gastrointestinal			
Confirm Helicobacter pylori infection/ monitor response to treatment	Carbon-14 urea breathe test	Nothing to eat or drink (other than water) for 6-8 hours before test Confirm with nuclear medicine facility but, in general, antibiotics and bismuth-containing drugs should be stopped for 28 days before the test; drugs to treat stomach ulcers should be stopped 48 hours before the test.	30 minutes
Gastric emptying disorders e.g.: • diagnosis and follow-up of gastro paresis • rapid gastric emptying/dumping syndrome • investigate epigastric discomfort and bloating, • post-gastric surgery assessment	Gastric emptying study	Nothing to eat or drink for 6-8 hours before test	2-3 hours

CLINICAL INDICATION	PROCEDURE TO REQUEST	PATIENT PREPARATION	APPROXIMATE TIME
Investigate function of the colon, assess the severity and type of constipation	Colonic transit study	Preparation instructions vary according to indications. Please contact the nuclear medicine service for specific information.	Day 1 (Monday) allow the whole day - radioactive drink in the morning, scan 6 hours later Days 2-5 - repeat scanning - allow 30 minutes each day
Oesophageal motility disorders • achalasia • dysmotility • reflux/aspiration • scleroderma	Oesophageal transit study	Generally, patients will be required to have nothing to eat or drink (other than water) for 4-6 hours before the test.	30 minutes. In some cases delayed views at 24 hours for assessment of aspiration may be acquired
Acute gastrointestinal bleeding	Gastrointestinal bleeding scan	No patient preparation	1½ -2 hours Repeat images may be required 24 hours later
Inflammatory bowel disease	Labelled white blood cell scan	No patient preparation	Up to 5 hours Repeat images may be required the following day.
Meckel's diverticulum	Meckel's scan	Generally, patients will be required to have nothing to eat or drink (other than water) for 4-6 hours before test. Patients may be asked to take an H_2 blocker such as Ranitidine at specified intervals before the test.	1-1½ hours
Salivary gland dysfunction	Salivary scan/study	Generally, no patient preparation	1-1½ hours

CLINICAL INDICATION	PROCEDURE TO REQUEST	PATIENT PREPARATION	APPROXIMATE TIME
Infection/inflammation			
Assess sites of possible infection and inflammation - a means of detecting infection or inflammation in bone, joints and soft tissue as well as inflammation due to other causes, such as inflammatory bowel disease (Ulcerative colitis and Crohn's disease) Occult infection/PUO	Infection scan (Gallium scan, labelled white blood cell scan or Leukoscan depending on indications)	No patient preparation	Up to 6 hours Repeat scan may be required the following day.
Assess bone marrow distribution - supplement a bone scan and/or a Gallium or labelled white blood cell scan when looking for infection in bones and joints	Bone marrow scan	No patient preparation	1-1½ hours
Liver/spleen			
Assess size, shape, position and function of liver and spleen helping to diagnose: • focal disease (tumour, abscess, cyst, trauma) • chronic liver disease • portal hypertension	Liver/spleen scan	No patient preparation Patients should not have had a barium meal or enema in the preceding 48 hours.	1-1½ hours
Evaluate liver mass to diagnose (or exclude) haemangioma	Labelled red blood cell liver/ haemangioma scan (sometimes called a liver blood pool scan)	No patient preparation	3-4 hours
Examine the spleen or identify sites of residual splenic tissue if the spleen has been damaged, operated on or removed in the past	Heat damaged red blood cell scan	No patient preparation	2-3 hours

CLINICAL INDICATION	PROCEDURE TO REQUEST	PATIENT PREPARATION	APPROXIMATE TIME
Lung			
• Suspected pulmonary embolism • Pre-operative assessment for lung volume reduction surgery • Ventilation lung clearance studies to assess activity of inflammatory lung disease	Ventilation/perfusion (V/Q) lung scan Lung perfusion scan Lung ventilation study with dynamic images	No patient preparation Helpful to have had chest x-ray within 24 hours of scan to come with patient	1 hour
Lymphatic System			
Lymphoedema	(Peripheral) lymphoscintigraphy	No patient preparation	Up to 4 hours
Assess lymph drainage and identify sentinel lymph nodes, particularly in breast cancer and melanoma	Sentinel node scan/ lymphoscintigraphy	No patient preparation	Up to 3 hours
Lymphoma			
Staging and monitoring therapy	Gallium scan	No patient preparation	At least 2 appointments: 1. for injection of radiopharmaceutical - allow 30 minutes 2. return 24 or 48 hours later for scan - allow 1-2 hours. 3. Some patients may need to return for further scan - allow 1-2 hours.

Renal/Urinary Tract

If uncertain which renal scan to request, please discuss with nuclear medicine specialist.

CLINICAL INDICATION	PROCEDURE TO REQUEST	PATIENT PREPARATION	APPROXIMATE TIME
• Assess renal function, relative renal function. Can be very useful in assessing the function of renal transplant grafts. • Assess urinary drainage • Hypertension where narrowing of the renal arteries is suspected	DTPA or MAG3 renal scan with or without Frusemide DTPA or MAG3 renal scan with or without ACE inhibiter (usually Captopril)	Patients should eat as normal then drink 2-4 glasses of water in the hour before their appointment. Check with nuclear medicine service whether any medications such as diuretics or antihypertensives need to be stopped prior to the test.	1-3 hours
Displays viable cortical tissue, allows measurement of relative renal function, very sensitive test to indicate the presence of renal scars or active infection (pyelonephritis)	DMSA renal scan	No patient preparation	Up to 5 hours
Renal function	Glomerular filtration rate (GFR)	No patient preparation	Up to 4 hours
Urinary reflux	Cystogram	No fluids for 4 hours before test	1 hour

CLINICAL INDICATION	PROCEDURE TO REQUEST	PATIENT PREPARATION	APPROXIMATE TIME
Thyroid			
• Hyperthyroidism (e.g. Graves Disease, thyroiditis, toxic adenomas) • Enlargement of thyroid gland (goitre) • Thyroid nodules	Thyroid scan	Generally no patient preparation Thyroid medication may need to cease before the test. Patients will be instructed accordingly when their appointment is made. When they make their appointment, patients should advise staff if they have had a contrast injection for a CT scan in the previous 4 weeks.	1 hour
• Determine whether any residual normal thyroid tissue following thyroid surgery • Determine whether any residual thyroid tumour	I-123 or I-131 whole body scan	Some medication needs to cease before the test. Patients will be instructed as to which medications when their appointment is made. Some patients require blood tests on the day before the test to check whether any thyroid tissue is stimulated or whether the patient may be pregnant. An appointment should be made accordingly.	Blood test the previous day if required. At least 2 appointments: 1. To take I-123 (drink) or I-131 (capsule) - allow 30 minutes 2. Return 1-3 days later for scan - allow 1-2 hours.
Other Endocrinology			
Assess for parathyroid adenoma or hyperparathyroidism, often when elevated blood calcium levels have been detected.	Parathyroid scan	No patient preparation	Up to 4 hours
Suspected phaeochromocytoma or other tumours composed of cells derived from, or related to, medullary cells of the adrenal glands.	MIBG (adrenal) scan	Many drugs can interfere with this study and may need to be stopped for up to a week or longer before the scan. Please contact the nuclear medicine service for specific information.	Up to 24 hours

CLINICAL INDICATION	PROCEDURE TO REQUEST	PATIENT PREPARATION	APPROXIMATE TIME
Tumours (other than, e.g. bone, brain, lymphoma, thyroid as listed above)			
Carcinoid (neuroendocrine) tumours	Indium-labelled octreotide scan	No patient preparation	Scans are generally performed 4-6 and 24 hours after injection of radiopharmaceutical. Allow 1-1½ hours for each scan. Occasionally, delayed views are required at 48 hours.
Other tumours	Gallium, Thallium, DMSA and MIBI scans can be useful in diagnosing a wide variety of tumour types.	Contact the nuclear medicine service to discuss the most appropriate scan for a given patient. Ask the nuclear medicine service for information regarding patient preparation and approximate time required for the scan to be performed.	
Other indications			
Blockage in lacrimal drainage system (excessive tearing)	Lacrimal scan	No patient preparation	Up to 1 hour
Assess presence/patency of Leveen shunt	Leveen shunt scan/study	No patient preparation	Up to 4 hours

Nuclear Medicine Therapy

Radioactive iodine (I 131) is used to treat hyperthyroidism and thyroid cancer. Other radiopharmaceuticals are used to treat joint pain, including some types of arthritis, to reduce the pain from bony metastases, and to treat some other cancers.

For more information about the nuclear medicine therapies that are available, please discuss the therapeutic needs of your patient with a nuclear medicine specialist.

PET SCANS

NOTE ▪ All situations where PET would be useful are not covered by Medicare so please discuss with your nuclear medicine specialist colleague. ▪ In Australia, most PET scanners operate in conjunction with a low dose CT for purposes of anatomical localisation and attenuation correction. ▪ The term 'PET' includes PET/CT.

PET scans currently attracting Medicare benefits

CLINICAL CONDITION	WHEN TO USE PET	MEDICARE ELIGIBLE
Colorectal cancer	• Staging following pathological confirmation • Pre- and post-surgical metastatic assessment • Determine treatment effectiveness • Suspected recurrence with rising CEA • Guide radiotherapy treatment planning	Following initial therapy, for evaluation of suspected residual, metastatic or recurrent colorectal carcinoma in patients considered suitable for active therapy (with / without catheterisation of the bladder)
Lung cancer (NSC)	• Staging following pathological confirmation • Pre- and post-treatment metastatic assessment • Determine treatment effectiveness • Assess suspected recurrence • Guide radiotherapy treatment planning	For the staging of proven non-small cell lung cancer, where curative surgery or radiotherapy is planned
Melanoma	• Initial staging for distant metastases to guide treatment • Pre- and post-chemotherapy for treatment effectiveness • Localise and restage possible recurrence **Not indicated for staging of regional node involvement**	Following initial therapy, for evaluation of suspected metastatic or recurrent malignant melanoma in patients considered suitable for active therapy (with / without catheterisation of the bladder)
Ovarian cancer	• Initial staging for distant metastases to guide treatment • Following initial therapy, evaluate suspected residual, metastatic or recurrent carcinoma in patients considered suitable for active therapy	Following initial therapy, for evaluation of suspected residual, metastatic or recurrent ovarian carcinoma in patients considered suitable for active therapy (with / without catheterisation of the bladder)
Solitary pulmonary nodule	Solitary pulmonary nodules between 0.5-3 cm	For evaluation of a solitary pulmonary nodule where the lesion is considered unsuitable for transthoracic fine needle aspiration biopsy, or for which an attempt at pathological characterisation has failed.

CLINICAL CONDITION	WHEN TO USE PET	MEDICARE ELIGIBLE
Refractory epilepsy	Localise seizure focus prior to surgery	For evaluation of refractory epilepsy in patients being considered for surgery

Medicare eligibility under consideration by the Medical Services Advisory Committee (MSAC)

Brain cancer	• Assessment of primary brain tumours • Assessment of grade and recurrent disease post-therapy	At the time of printing, Medicare eligibility for PET scans for glioma is under consideration by MSAC. Please check the ANZAPNM website at www.anzapnm.org.au for current status.
Breast cancer	• Initial staging for distant metastases to guide treatment • Pre- and post-chemotherapy for treatment effectiveness • Assess possible recurrence • Guide radiotherapy treatment planning **Not indicated for primary/initial diagnosis** **Not indicated for initial staging of axilla**	At the time of printing, Medicare eligibility is under consideration by MSAC. Please check the ANZAPNM website at www.anzapnm.org.au for current status.
Cervical cancer	• Initial staging • Assessment of recurrent disease • Guide radiotherapy treatment planning	At the time of printing, Medicare eligibility is under consideration by MSAC. Please check the ANZAPNM website at www.anzapnm.org.au for current status.
Head & neck cancer **(continues over page)**	• Staging to guide treatment • Investigate metastatic disease involving cervical lymph nodes from an unknown primary site • Determine treatment effectiveness • Assess recurrence Post surgical anatomical changes reduce accuracy of CT-only assessment • Guide radiotherapy treatment planning	• For the staging of biopsy-proven, newly diagnosed or recurrent head and neck cancer • For the evaluation of patients with suspected residual head and neck cancer after definitive treatment, and who are suitable for active therapy • For the evaluation of metastatic squamous cell carcinoma of an unknown primary site involving cervical nodes (with / without catheterisation of the bladder)

CLINICAL CONDITION	WHEN TO USE PET	MEDICARE ELIGIBLE
Head & neck cancer **(continued from previous page)**		**Not expected to be available on the Medicare Benefits Schedule before 1 July 2009.** Please check the ANZAPNM website at www.anzapnm.org.au after 1 July 2009 for current status.
Lymphomas	• Stage known disease to guide treatment • Pre- and post-chemotherapy monitoring • Guide radiotherapy treatment planning	At the time of printing, Medicare eligibility is under consideration by MSAC. Please check the ANZAPNM website at www.anzapnm.org.au for current status.
Myocardial viability	Assessment of extent of viable myocardium prior to consideration of possible revascularization	At the time of printing, Medicare eligibility is under consideration by MSAC. Please check the ANZAPNM website at www.anzapnm.org.au for current status.
Oesophageal/ gastro-oesophageal junction cancer	• Staging of regional and distant metastases. • Pre- and post-treatment metastatic assessment • Assess effect of neoadjuvant chemoradiotherapy • Assess suspected recurrence • Guide radiotherapy treatment planning	For the staging of proven oesophageal or gastro-oesophageal junction carcinoma, in patients considered suitable for active therapy **Not expected to be available on the Medicare Benefits Schedule before 1 July 2009.** Please check the ANZAPNM website at www.anzapnm.org.au after 1 July 2009 for current status.
Sarcoma	• Guide biopsy of a suspected sarcoma • Staging of biopsy-proven sarcoma being considered for resection of the primary or limited metastatic disease • Evaluation of suspected residual or recurrent sarcoma on structural imaging after definitive therapy	At the time of printing, Medicare eligibility is under consideration by MSAC. Please check the ANZAPNM website at www.anzapnm.org.au for current status.

CLINICAL CONDITION	WHEN TO USE PET	MEDICARE ELIGIBLE
NOT currently under consideration for Medicare eligibility but potentially useful		
Adenocarcinoma of unknown primary	Identify location of primary in adenocarcinoma of unknown primary site	Not at present
Bone cancer	Assessment of possible metastatic disease	Not at present
Gastric cancer	May be useful for staging	Not at present
Gastrointestinal stromal tumour (GIST)	Assessment and management of patients with GIST	Not at present
Merkel cell cancer	• Staging of patients for regional lymphadenopathy and metastases prior to definitive treatment • Assessment of recurrent disease	Not at present
Neuroendocrine tumour	^{68}Gallium DOTATOC for assessment of suspected neuroendocrine tumour	Not at present
Thyroid cancer	Restaging after surgery and radioablation in patients with negative radioiodine scans and ultrasound or biochemical evidence of recurrent disease	Not at present
Dementia	• Differentiate Alzheimer's disease from other forms of dementia such as frontotemporal dementia • Following 6 months of documented symptoms • Following MMSE evaluation • Following equivocal MRI • When Alzheimer's disease diagnosis is still in question	Not at present

Source: Australian and New Zealand Association of Physicians in Nuclear Medicine (ANZAPNM), Academy of Molecular Imaging (AMI), National Oncologic PET Registry

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