Referring Patients for PET/CT Procedures at the Birmingham PET Centre

Introduction

The Ionising Radiation (Medical Exposure) Regulations [IR(ME)R] 2017 make it necessary for all investigations using ionising radiation to be justified on an individual patient basis. To meet this requirement, the Birmingham PET Centre has produced the below table of referral criteria which, if met, would justify a PET/CT procedure under most circumstances. These are taken from professional body guidelines including:

Royal College of Radiologists – Evidence-based indications for the use of PET-CT in the United Kingdom 2022 – www.rcr.ac.uk
British Nuclear Medicine Society – www.bnms.org.uk
European Association of Nuclear Medicine – www.eanm.org
Society of Nuclear Medicine – www.snm.org

Referring Patients

Referrals are accepted from any hospital doctor who is, or is acting on behalf of, a Consultant. The name of the referrer and Consultant must be clearly stated on the request, even if these are the same person. Referrals will be accepted as per Points 4.1-4.6 in Trust IRMER Procedure 2 and those identified within Appendix 1 Table 1. Referrals from NMRs will not be accepted. Referrals received from a Junior Doctor must have been discussed with a Consultant beforehand and this must be indicated on the referral.

For all referrals, please ensure that the patient is informed that they will be sent for a PET/CT scan before sending in the referral request. For many PET/CT scans, a radioactive dose will be ordered in advance for each patient. Where patients cancel at short notice, we are unable to use the radioactive dose for another patient. All efforts will be made to process requests as soon as possible upon receipt.

Clinical Information

Under IRMER, it is essential that requests for PET/CT procedures contain sufficient clinical detail to allow the justification and authorisation of the procedure by PET Centre staff. The regulations clearly state the responsibility of the referrer:

“The referrer must supply the PET/CT practitioner with sufficient medical data (such as previous diagnostic information or medical records) relevant to the exposure requested by the referrer to enable the practitioner to decide whether there is a sufficient net benefit.

Please note that the referrer remains responsible for the referral even if the task is delegated to another hospital doctor acting on their behalf. The practitioner for a PET/CT procedure will always be an IRMER Practitioner License Holder, where the Practitioner's license is issued by ARSAC.

Patient Information Request

The following information about the patient is required as a minimum:

- Patient Surname
- Patient Forename
- Date of Birth
- Address
- Hospital Number/ID
- Examination Requested
- Sufficient clinical information relevant to justify the medical exposure requested
- Indication of pregnancy and breast feeding as appropriate
- In the case of pregnancy, the Referrer should confirm that a risk benefit discussion with the patient has taken place
- Mobility Status
- Co-morbidities (where relevant)
- Medication
- Carer or comforter requirements or other relevant radiation protection information
- Indication of known potential medical complications associated with examination requested e.g. allergy, renal function (for CT contrast)
- Signature of Referrer (this may be physical or in terms of an electronically validated request)
- Name of Referrer
- Date of Referral
- Name of Consultant
- Hospital / Ward / Department / GP Surgery
- Research Trial (should be clearly identified)

Please be patient if PET Centre staff contact you to ask for more information. Any referral not providing appropriate information as above will not be progressed and the department will contact the Referrer accordingly.

Radiation Protection of Other People

PET/CT investigations are different from other radiological investigations because the patients themselves become radioactive and may therefore pose a radiation risk to others. Please pay particular attention to any instruction sent back with the patient,

regarding whether urine and blood samples can be taken, bearing in mind these may both be radioactive. Occasionally, investigations or treatments cannot be carried out because of the patient's family circumstances.

Radiation Dose to the Patient, Pregnancy and Breastfeeding

The list of investigations following contains information about the radiation dose received (in mSv) by the patient from the procedure and this must be borne in mind when considering the suitability of using a PET/CT procedure. As a guide, the natural background radiation dose received by any person is about 2.3 mSv per annum. In the pregnant patient, there is also a radiation dose to the foetus; this must be strictly limited, and a Referrer should have a risk benefit discussion with the patient prior to the referral. Furthermore, many radiopharmaceuticals appear in breast milk, so the breast-fed infant would receive a radiation dose. For these reasons, the fact or possibility of pregnancy or breastfeeding must be clearly stated in the request for all individuals of childbearing potential in the age range 11-55 years old, inclusive.

Supplementary Drugs

In addition, some investigations require the administration of other, non-radioactive pharmaceuticals as an essential part of the test. These are specified in italics after the relevant referral criteria. Your request for an investigation will be taken as implying agreement to the administration of the specified supplementary drug (this includes the administration of saline). If you are unhappy about your patient being given these drugs or feel they are contraindicated, this must be clearly stated in the request.

Less Common Procedures

There may be other procedures which fall into the category of research investigations and the Practitioner should be contacted.

Please note that if a referral is made and then cancelled by the Referrer the PET Centre **MUST** be contacted (see details below) to cancel the request.

Birmingham PET Centre
birminghampet@uhb.nhs.uk
0121 371 7220

Reports

Patients referred will have images on PACS and reports available on PACS, CRIS, PICS and Clinical Portal once they are finalised. External reports and images will be sent via Image Exchange Portal (IEP).

PET/CT Referral Criteria

Internal referrals will be made electronically via PICS. External PET/CT referrals should be sent on the appropriate form which can be found on the UHB PET Website.

Investigation & Clinical History	Radiopharmaceutical	Effective dose incl. CT (mSv)	Risk classification
ONCOLOGICAL IMAGING			
General • Staging, restaging or recurrence • Assessment of end of treatment response to chemotherapy and/or radiation treatment • Assessment of disease extension	F-18 FDG	11.1-11.3	Low
Lung • Characterisation of abnormality in patients with other imaging is negative or equivocal or biopsy is inconclusive, or biopsy cannot be performed • Characterisation of solitary pulmonary nodule (differentiation of benign versus malignant lesions where anatomical imaging or biopsy is inconclusive, or biopsy cannot be performed) • Pre-operative staging of non-small cell primary lung tumours • Staging of patients with small-cell lung cancer with limited disease on CT being considered for radical therapy • Assessment of suspected disease recurrence to differentiate between treatment effects and recurrent cancer • **Note: For lung pathology, referrers are required to state on the request the size and location of the lesion within the lungs. If lesion is below 8mm then the request must be sent to an IRMER Practitioner License Holder for approval. For external hospitals the latest CT report must also be provided**	F-18 FDG	11.1	Low
Pleural malignancy • To guide biopsy in patients with suspected pleural malignancy with pleural thickening • To exclude extra-thoracic disease in proven mesothelioma in patients considered for multimodality treatment including radical surgery/decortication • Response assessment to therapy where there is uncertainty on conventional imaging	F-18 FDG	11.1	Low

Thymic tumours • Staging of patients considered for surgical resection • Assessment of indeterminate thymic lesions if being considered for radical treatment • Response assessment to therapy where there is uncertainty on conventional imaging	F-18 FDG	11.1	Low
Oesophageal and Oesophago-gastric carcinoma • Staging or restaging patients with oesophageal or oesophago-gastric carcinoma, suitable for radical treatment, including patients who have received neo-adjuvant treatment • Evaluation of suspected recurrence of oesophago-gastric tumours when other imaging is negative or equivocal • For radiotherapy planning/volume delineation of oesophageal and oesophago-gastric junction cancers	F-18 FDG	11.1	Low
Breast carcinoma • Assessment of multi-focal disease or suspected recurrence in patients with breast carcinoma • Differentiation of treatment-induced brachial plexopathy from tumour infiltration in symptomatic patients with an equivocal or normal MRI • Assessment of response to chemotherapy in patients whose disease is not well demonstrated using other techniques	F-18 FDG	11.1	Low
Hepato-pancreaticobiliary cancers • Staging of patients with potentially operable hepato-pancreaticobiliary (e.g. cholangiocarcinoma, gallbladder or hepatocellular carcinoma) cancers where cross-sectional imaging is equivocal for metastatic disease and a positive PET/CT would lead to a decision not to operate • Differentiate carcinoma from chronic pancreatitis • Identification of poor prognosis hepatocellular carcinoma (HCC) • Predicting probability of early recurrence after liver transplantation for HCC	F-18 FDG	11.1	Low
Colorectal carcinoma	F-18 FDG	11.1	Low

• Staging of patients with synchronous metastases at presentation suitable for resection or patients with equivocal findings on other imaging (pulmonary or liver lesions) • Detection of recurrence in patients with rising tumour markers and/or clinical suspicion of recurrence with normal or equivocal findings on other imaging • Evaluation of indeterminate pre-sacral masses post-treatment • PET/CT follow up after liver metastasis ablation • Monitoring metabolic response in patients with metastatic colorectal cancer being treated with oral multikinase and immune checkpoint inhibitors			
Urological malignancy • Assessment of metastatic renal or ureteric carcinoma • Assessment of extra-renal or extra-ureteric carcinoma at staging in selected cases with equivocal findings on other imaging • Assessment of disease recurrence within the nephrectomy bed • In the setting of proven muscle invasive bladder cancer or high-risk non-muscle-invasive bladder cancer before radical treatment if there are indeterminate findings on CT or MRI, or a high-risk of metastatic disease	F-18 FDG	11.1	Low
Gynaecological malignancy (vulvar, uterine, cervix or endometrium carcinoma) • Detection of tumour in selected patients with ovarian carcinoma who have rising CA125 levels and equivocal or negative imaging	F-18 FDG	11.1	Low
Testicular malignancy • In selected cases of primary staging of testicular germ cell tumours with equivocal findings on conventional work-up • Assessment of recurrent disease in patients with metastatic seminoma or teratoma with elevated or rising tumour markers and equivocal or normal anatomical imaging • Evaluation of residual masses for patients with seminoma and teratoma	F-18 FDG	11.1	Low

Anal and penile carcinoma • For staging in patients with T2-T4 anal tumours suitable for radical treatment • Staging of high-risk penile carcinoma	F-18 FDG	11.1	Low
Paraneoplastic Syndrome • To detect an occult primary tumour in patients with non-metastatic manifestations of neoplastic disease when other imaging is negative or equivocal	F-18 FDG	11.1	Low
Carcinoma – unknown origin • Detection of the primary site when imaging and histopathology have failed to show a primary site, where the site of tumour will influence the choice of treatment	F-18 FDG	11.1	Low
Lymphoma • Interim response assessment of patients after two cycles of chemotherapy if there is clinical suspicious of progression of NHL • End of treatment remission assessment of HD and aggressive NHL. Not required for patients with CMR on interim scans. • Evaluation of suspected relapse in symptomatic patients • Assessment of response to second line treatment and subsequent treatments • Staging and restaging of suspected post-transplant lympho-proliferative disorder (PTLD) • Prior to bone marrow transplant to assess volume of disease and suitability for transplant	F-18 FDG	11.1	Low
Myeloma • Characterisation of equivocal CT abnormality • Distinguish between smouldering and active myeloma • Assessment of patients with apparently solitary plasmacytoma or patients with ambiguous lytic lesions on skeletal survey • Suspected relapse in patients with non-secretory myeloma or predominantly extramedullary disease • To investigate elevated tumour markers	F-18 FDG	11.3	Low
Skin tumours • Characterisation of equivocal CT abnormality	F-18 FDG	11.3	Low

• To assess for distant disease in patients with melanoma when radical dissection is contemplated • Work-up of locally advanced (unresectable) and metastatic Merkel cell carcinoma • Assess response to isolated limb infusion for malignant melanoma • Exclude systemic involvement in skin lymphomas and exclude large cell transformation in mycosis Fungoides • Exclude primary malignancy where dermatomyositis suspected to represent a paraneoplastic manifestation • **Note: FDG PET/CT scan is not indicated for early-stage patients who should undergo sentinel node biopsy**			
Musculoskeletal • Characterisation of equivocal CT abnormality • Staging of high-grade sarcomas, unless already proven to have metastatic disease (Ewing's sarcoma, rhabdomyosarcoma, leiomyosarcoma, osteosarcoma, malignant fibrous histiocytoma, synovial sarcoma and myxoid liposarcoma) • Pre-amputation in the setting of a high-grade sarcoma where the detection of distant disease will alter the surgical management • Stage patients with metastatic sarcoma considered for liver or lung metastasectomy where anatomical imaging has not identified any extra-thoracic or extra-hepatic disease which would preclude surgery • Assessment of suspected malignant transformation within plexiform neurofibromas in patients with neurofibromatosis type 1	F-18 FDG	11.3	Low
Head & neck tumours (ear, nose, throat) • Staging of patients where staging is difficult clinically; for example, patients with trismus or where there is uncertainty on other imaging or equivocal findings that would preclude radical treatment • Identify unknown primary site in patients presenting with metastatic squamous cell carcinoma in cervical lymph nodes	F-18 FDG	11.1	Low

• Response assessment 4 months' post chemo-radiotherapy • Differentiate relapse from treatment effects in patients suspected to have tumour recurrence • Identify tumour recurrence in the post-operative, post-chemotherapy or post-radiotherapy			
Thyroid carcinoma • Assessment of patients with elevated thyroglobulin levels and negative iodine scintigraphy with suspected recurrent disease • To evaluate disease in treated medullary thyroid carcinoma (3-6 months' post chemo-radiotherapy) • Monitor response to tyrosine kinase inhibitor (TKI) therapy in patients with FDG-avid and non-iodine-avid disease • Evaluation of anaplastic thyroid cancer in highly selected cases based on a multidisciplinary decision where impact on clinical management is expected	F-18 FDG	11.1	Low
Prostate carcinoma • Biochemical relapse in patients post radical radiotherapy (recommended if PSA equal to/greater than 2 ng/ml + nadir) • Biochemical relapse in patients post radical prostatectomy (recommended if PSA equal to/greater than 0.2 ng/ml) • Biochemical relapse in patients post radical radiotherapy and post prostatectomy where PSA less than 0.2 ng/ml but they have a doubling time < 6 months and considering salvage therapy i.e. SABR • Primary staging in high-risk prostate cancer i.e. equivocal lesions on baseline conventional imaging, where management will be influenced by PSMA result. Also, in cases where there is a discordant biopsy result or contraindication to biopsy • Patients being considered for 177-Lutetium labelled PSMA ligand therapy	F-18 PSMA/ Ga-68 PSMA	20.5/ 18.2	Moderate /Low
Neuroendocrine tumours • Staging and restaging neuroendocrine tumours for treatment planning,	Ga-68 DOTA	17.3	Low

assessment of secondary pathology or de-differentiation • This can include well-differentiated, or poorly differentiated neuroendocrine tumours, phaeochromocytoma, paragangliomas and adrenal cortical carcinomas • Identify patients who are unlikely to respond to ^{177}Lu-Dotatate therapy (i.e. discordant lesions that are somatostatin receptor negative and FDG Positive) • Risk stratification of well-differentiated NETs for treatment planning			
NON-ONCOLOGICAL IMAGING			
Brain • Localisation of epileptogenic focus in epilepsy in adults • Pre-surgical assessment of medical refractory epilepsy • Evaluation of memory loss/neurological signs suggestive of dementia or to differentiate types of dementia in selected patients	F-18 FDG	5.1	Low
Parathyroid • Parathyroid adenoma localisation prior to surgery when location of adenoma(s) on first line imaging (ultrasonography, sestamibi SPECT-CT, 4D-CT) cannot be confidently determined • Persistent post-surgery/recurrent primary hyperparathyroidism when conventional imaging cannot confidently determine location • Staging of Parathyroid Carcinoma	F-18 Choline	13.0	Low
Vasculitis • Suspected large vessel vasculitis	F-18 FDG	11.1-11.3	Low
Sarcoidosis • Cardiac sarcoidosis • Systemic sarcoidosis	F-18 FDG	11.1-11.3	Low
Infection/pyrexia of unknown origin • Infection/pyrexia of unknown origin where conventional imaging has failed to identify a site	F-18 FDG	11.1-11.3	Low
SODIUM FLUORIDE (NaF) BONE IMAGING			
Bone diseases • Assessment of benign and malignant bone diseases in selected patients • **Note: NaF PET/CT imaging is only performed for patients under the**	F-18 NaF	21.3	Moderate

Preffir research trial at University Hospitals Birmingham			