

Role of PET-CT in Oncology

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Disclosures:

I have no financial interests/relationships to disclose

Overview

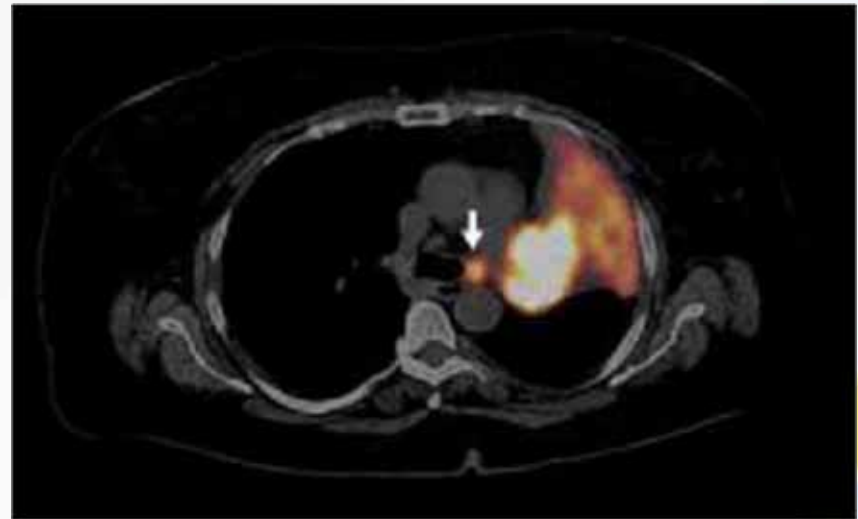
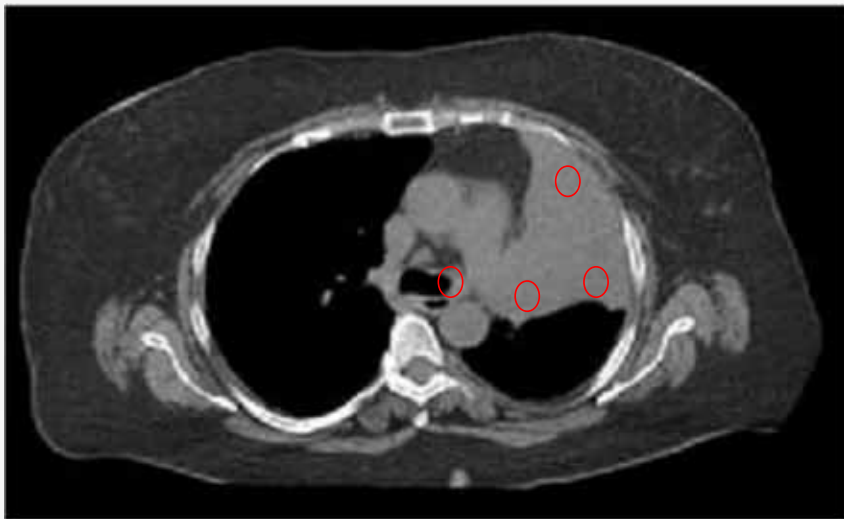
- Need for PET-CT
- Utility of PET-CT in Oncology
- Selected examples
- Where it isn't indicated/helpful
- Future directions

Need for PET-CT?

- Drawbacks of “Conventional imaging”- Xrays, CT, USG, MRI
Predominantly ‘Morphological’ information
-Size, Location & Vascularity
- ?Functional information-Metabolic activity, Cellular & Chemical composition
- “Personalised Medicine”-Growing need for “non invasive” molecular/cellular information
- PET-CT is perfectly suited!

1) Cancer Diagnosis

- High degree of clinical suspicion of malignancy
- Routine imaging-Inconclusive
- Repeated biopsies- Inconclusive/Non-contributory



PET-CT to detect and characterise lesions AND/OR guide biopsies

2) Cancer staging

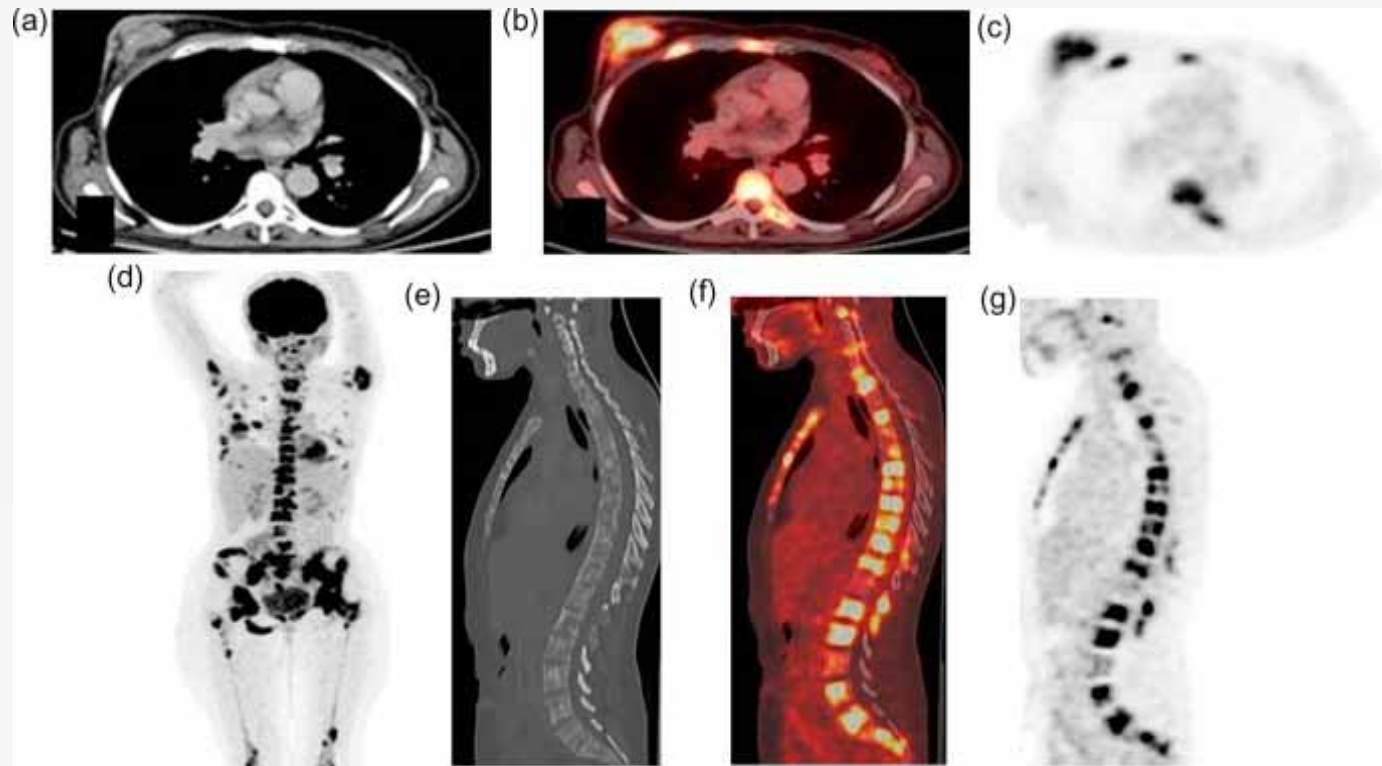
- Once a diagnosis is made (Biopsy is positive for malignancy)

PET-CT for “Staging” of cancer-TNM

T-Tumour, N-Node, M-Metastasis

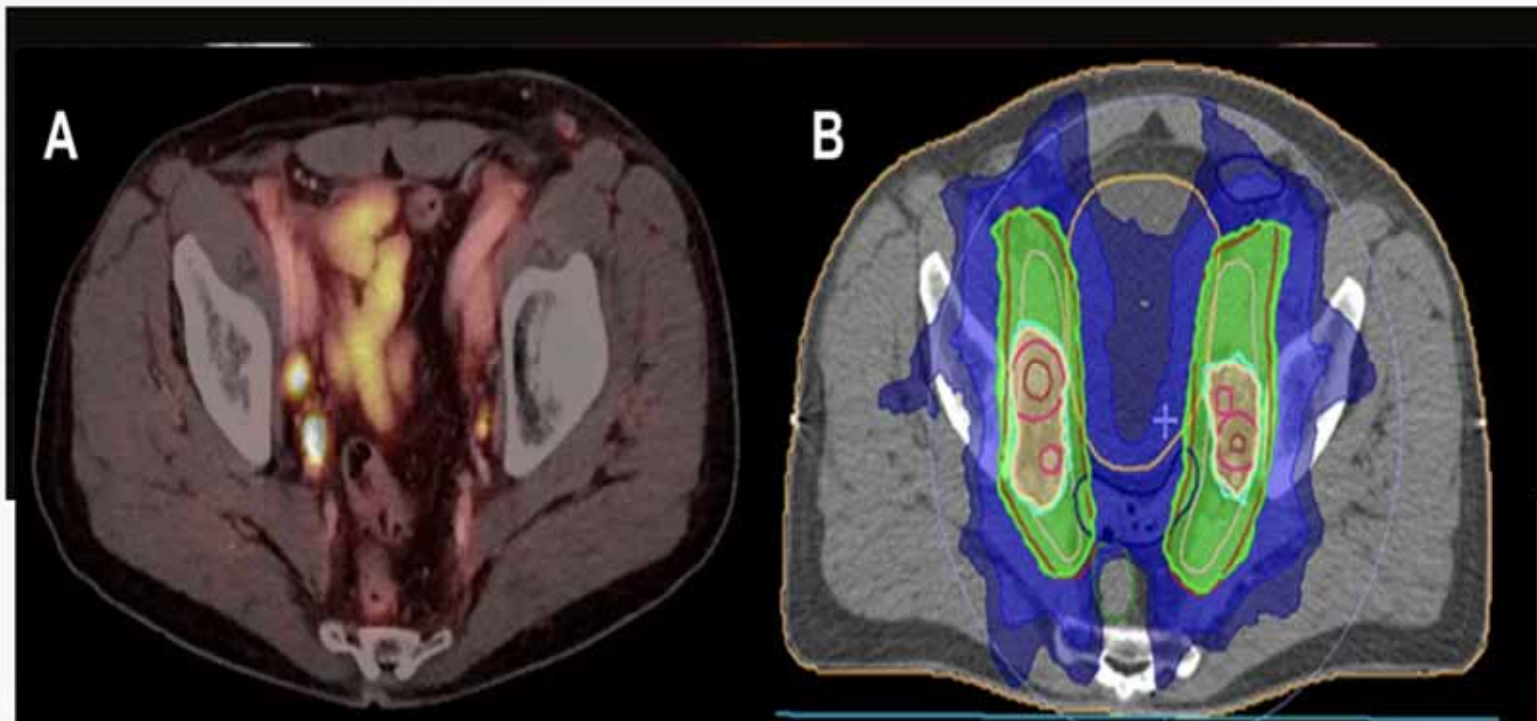
Selection of optimal treatment modality

2) Cancer staging



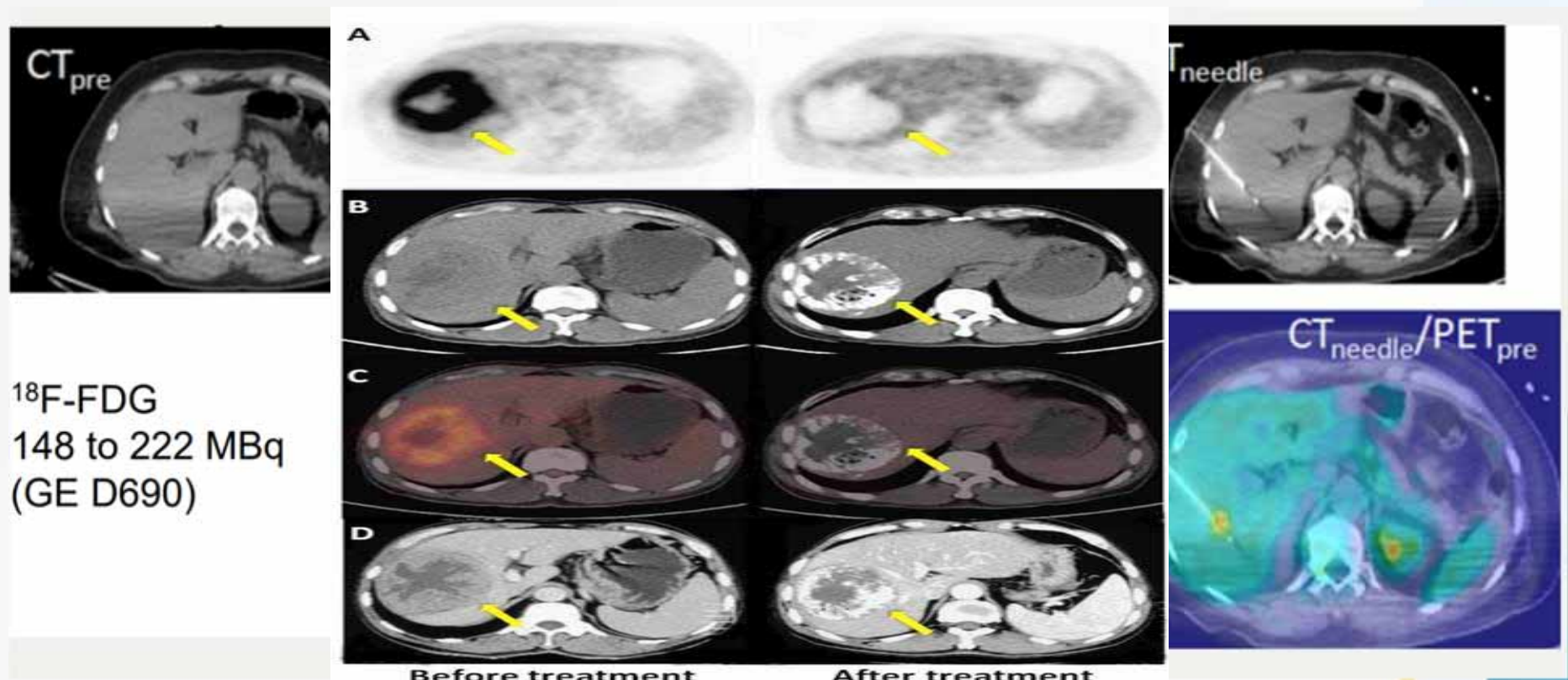
3) Guide precision Radiotherapy/ Interventional Radiology

- Delineating tumour volumes in Radiotherapy



<https://ro-journal.biomedcentral.com/articles/10.1186/s13014-020-01519-1/figures/5>

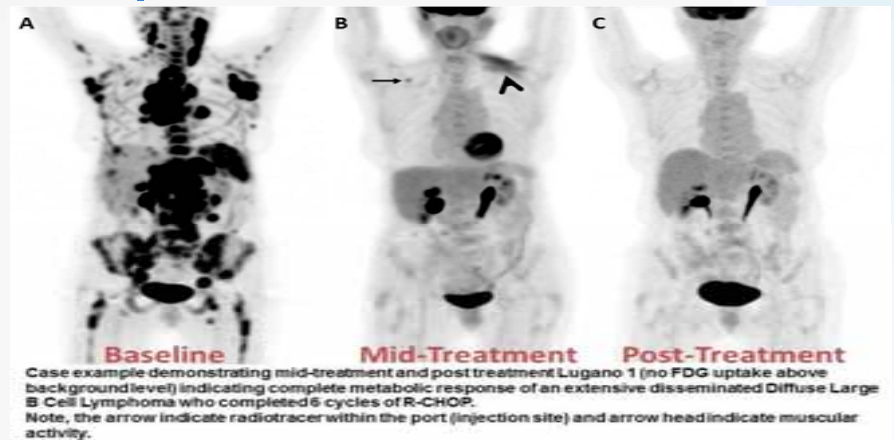
- Assessment of suitable sites, approach for IR procedures



<https://amos3.aapm.org/abstracts/pdf/155-53979-1531640-157228-2059870651.pdf>
<https://www.thno.org/v04p0736.htm>

4) Assessment of treatment response

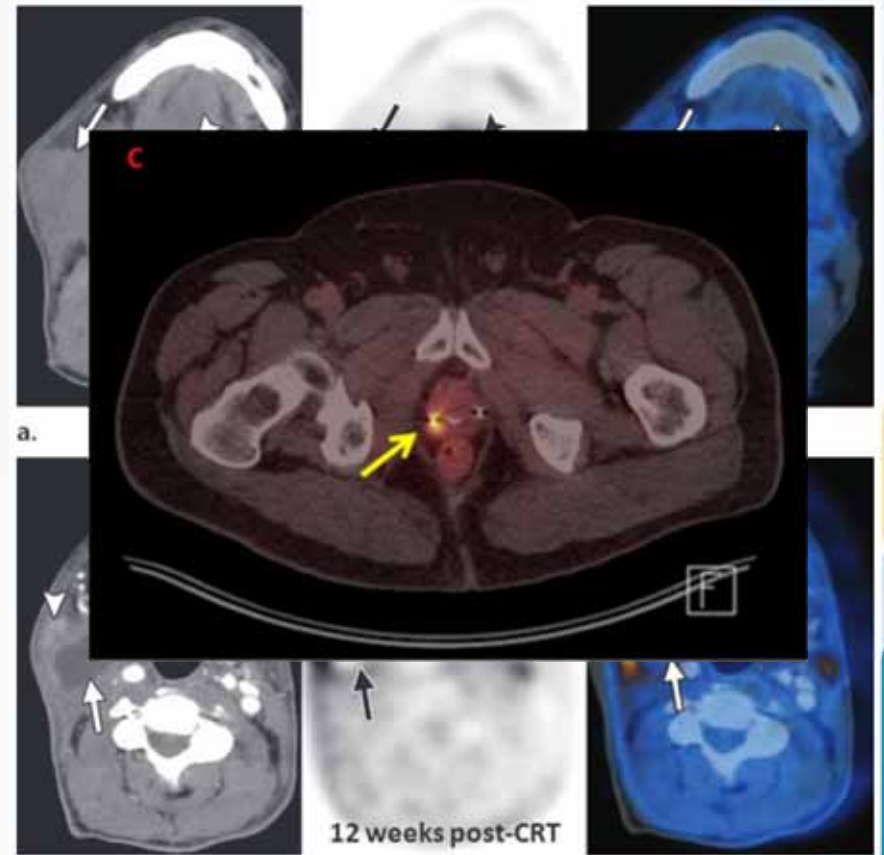
- Monitoring response to Systemic therapy and Radiotherapy-Selection of treatment regimens or prognosticate.
- Selection of patients suitable for surgery (who were not candidates for surgery at start of treatment)



5) Early detection of residual/recurrent disease

- After completion of cancer treatment, early detection of residual/recurrent disease- Higher chance of successful salvage.

Possibility of longer survival, lesser morbidity, improved QOL.



<https://doi.org/10.1148/rg.312095765>

Most common cancers in Mauritius (Males)

Utility of PET-CT

Site		Staging	Response assessment	Recurrence	Radiotherapy planning	Remarks
Prostate						
	Post prostatectomy/Radiotherapy			<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/>	Biochemical recurrence (≥ 0.2 ng/L after RP, Nadir +2ng/l after RT)
	High risk/Metastatic disease	<input checked="" type="checkbox"/>			<input type="checkbox"/> <input checked="" type="checkbox"/>	Equivocal results on imaging, Discordant biopsy, Candidates for Lutetium therapy
Colorectal/ Anal	Locally advanced/ Oligometastatic	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Lung		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Evaluation of solid nodule ≥ 8 mm, LS SCLC
Lymphoma		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Bladder	MIBC, High risk NMIBC	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		

Most common cancers in Mauritius (Females)

Utility of PET-CT

Site	Staging	Response assessment	Recurrence	Radiotherapy planning	Remarks
Breast	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Stage IIB/Metastatic disease
Colorectal/Anal	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Locally advanced/ Oligometastatic
Corpus Uteri	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		Locally advanced
Ovary and adnexa	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Locally advanced
Cervix	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	

Contraindications and where it isn't helpful!

- Pregnancy
 - Breast feeding
 - Class III obesity
 - Allergic reactions to radiopharmaceutical (very rare)
- **Not for routine screening in general population!**

Future directions?

- PET/MRI



Novel tracers

Tumour microenvironment (CAF)-FAPI

Cellular proliferation-FLT

Upregulated proteins-DLL3 and PARP1 (Biomarkers and targets)

Acidic and hypoxic areas

Analogues of Amino acids (Phe, Tyr, Met-Gliomas, Glu-Drug resistance)

Antibodies-PDL1, VEGFR, GD2 (Targets)

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9116257/>

Theranostics

Therapeutics+Diagnostics

“We treat what we see and see what we treat(ed)!”

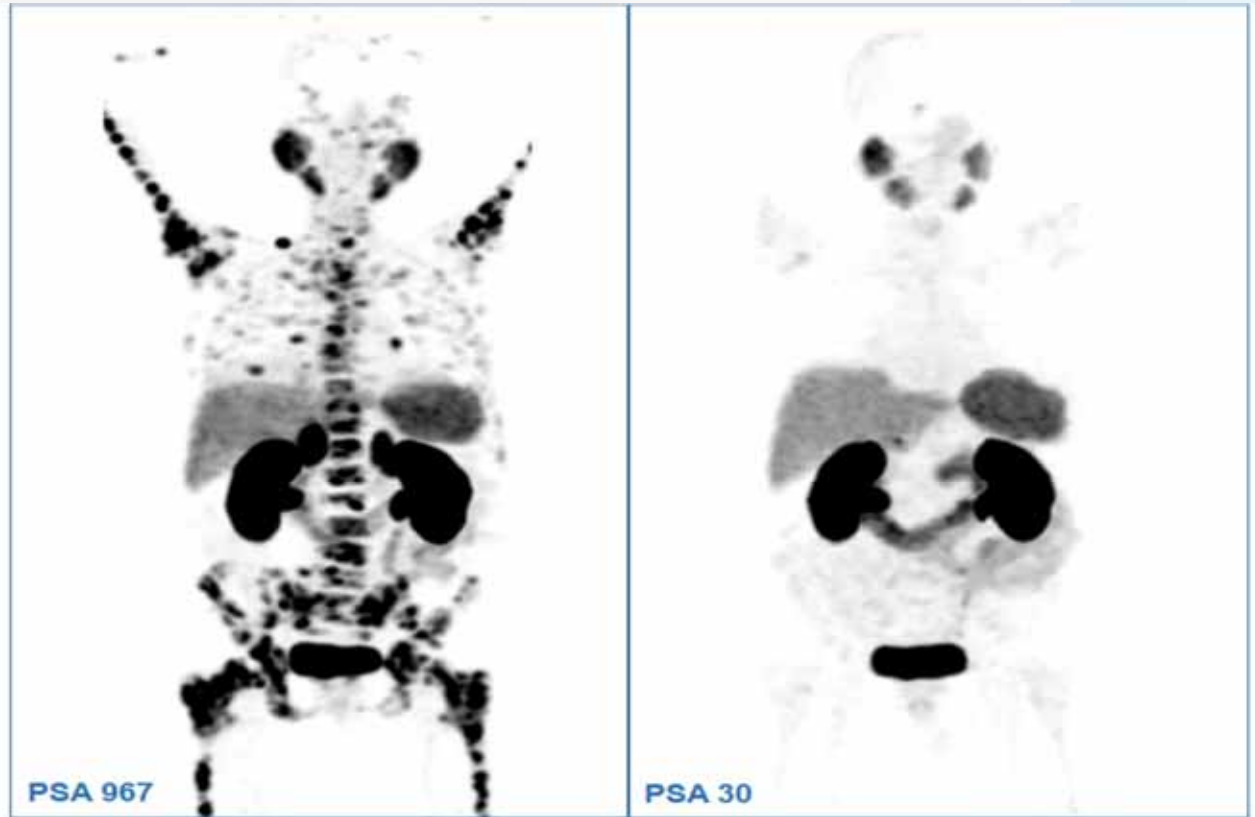
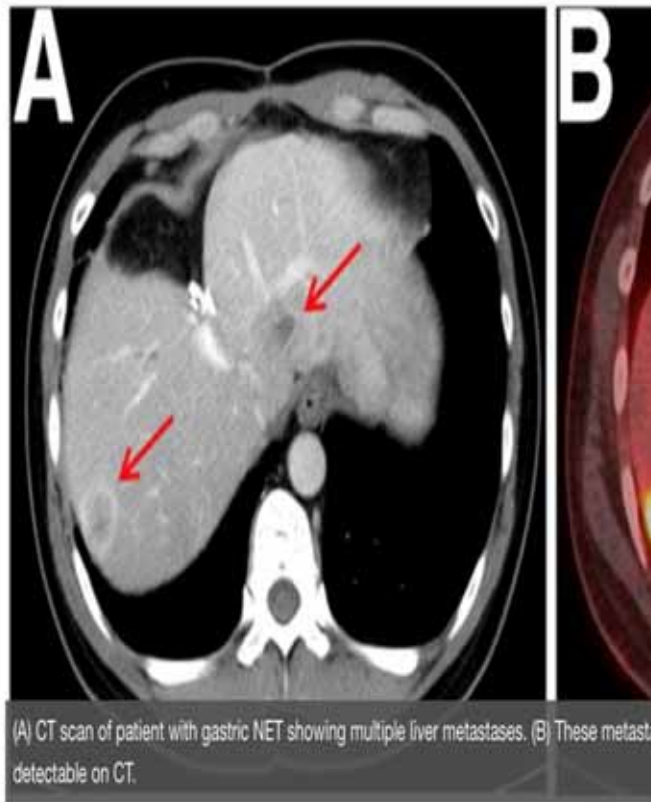


Diagnostic agents	Therapeutic agents	Molecular/ Cellular target	Function of target	Oncological conditions
⁶⁸ Ga-DOTATOC ⁶⁸ Ga-DOTATATE ⁶⁸ Ga- DOTANOC	¹⁷⁷ Lu-DOTATATE ⁹⁰ Y-DOTATATE ²²⁵ Ac-DOTATATE	SSTR	Cell-surface receptor	Well-differentiated neuroendo- crine tumors
⁶⁸ Ga-PSMA-11 ⁶⁸ Ga-PSMA-617 ⁶⁸ Ga-PSMA-I&T	¹⁷⁷ Lu-PSMA-617 ²²⁵ Ac-PSMA-617	PSMA	Cell-surface protein	Metastatic castration- resistant prostate cancer
⁶⁸ Ga-FAPI-04 and FAPI-derivatives	⁹⁰ Y, ¹⁷⁷ Lu or ¹⁵³ Sm-labeled FAPI-derivatives	FAP	Stroma of cancer-cell surface of activated fibroblasts	Various types of cancers- sarcomas, breast esophageal, lung, pancreatic, prostate cancers, etc.

Abbreviations: FAPI, fibroblast activation protein inhibitor; PSMA, prostate-specific membrane antigen; SSTR, somatostatin receptor.

<https://www.thieme-connect.com/products/ejournals/pdf/10.1055/s-0042-1760310.pdf>

Dramatic responses!



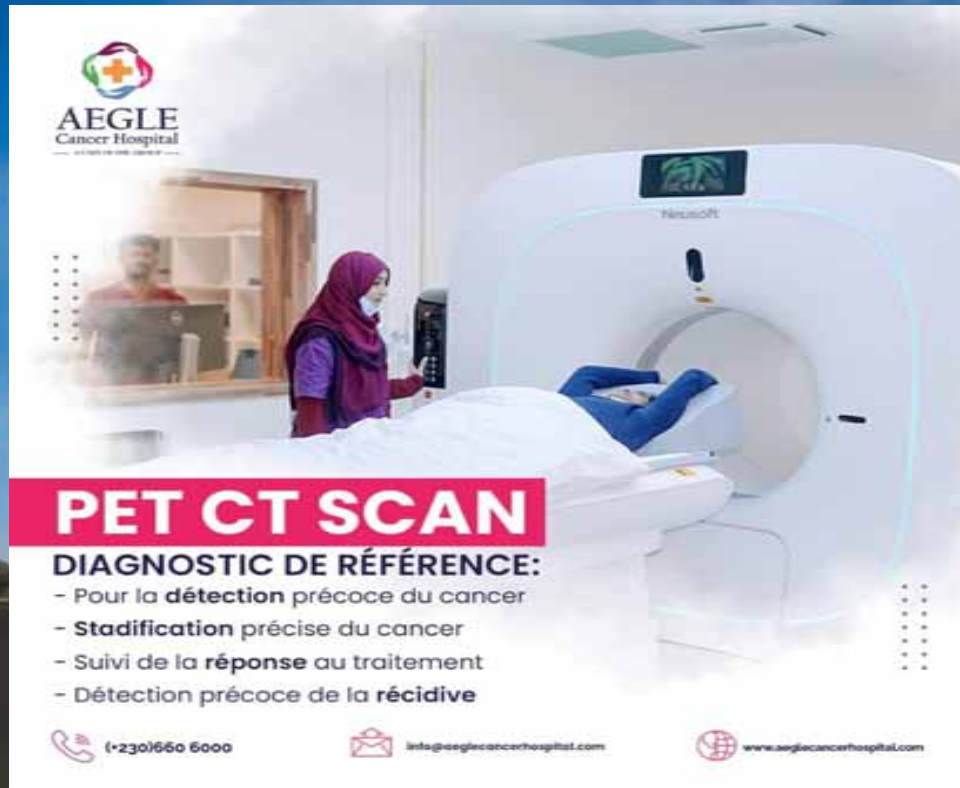
Lu177-PSMA-PET treatment of a man with prostate cancer. On the left is shown the PSMA-PET scan before treatment. On the right is the scan after the 2nd treatment with Lu177-PSMA-PET. Pictures supplied by A/Prof Michael Hofman, Peter MacCallum Cancer Centre.

https://jnm.snmjournals.org/content/60/Supplement_2/13S

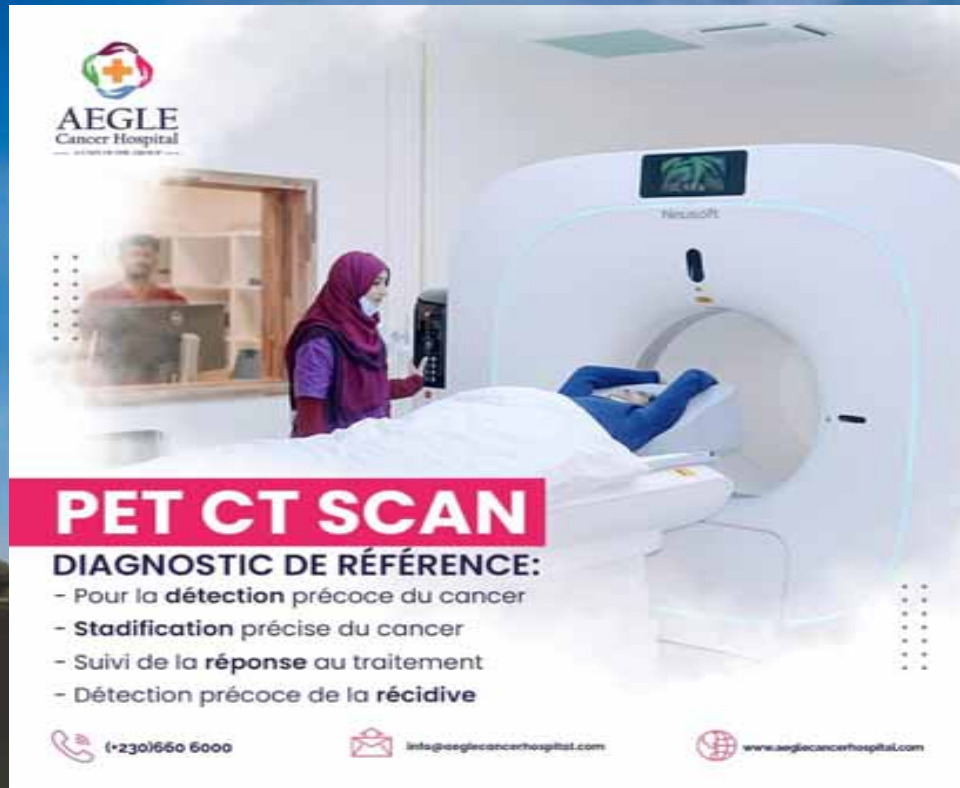
Guidelines/Recommendations for the use of PET-CT

- <https://www.nccn.org/compendia-templates/compendia/imaging-appropriate-use-criteria-nccn-imaging-auc> (**NCCN**)
- <https://hal.science/hal-02489793/document> (**French National Health Authority**)
- <https://www.scin.scot.nhs.uk/wp-content/uploads/2022/03/GUIDELINES-OVERVIEW-INDICATIONS-FOR-THE-USE-OF-PET-CT-IN-SCOTLAND.pdf> (**Scotland**)
- https://www.rcr.ac.uk/system/files/publication/field_publication_files/evidence-based_indications_for_the_use_of_pet-ct_in_the_united_kingdom_2022.pdf (**RCR UK**)

Questions?






AEGLE
Cancer Hospital



PET CT SCAN

DIAGNOSTIC DE RÉFÉRENCE:

- Pour la **détection** précoce du cancer
- **Stadification** précise du cancer
- Suivi de la **réponse** au traitement
- Détection précoce de la **récidive**

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I thank You!