Used radiopharmaceuticals in GI malignancies by PET/CT

By: Dr. Ashraf Fakhari,

Specialist in Radiopharmacy

Topics:

- Types of gastrointestinal cancers
- Treatment
- Indication of PET
- Radiopharmaceuticals

The most common types of gastrointestinal cancers are as follows:

- Esophageal cancer.
- Gastric (stomach) cancer.
- Colorectal cancer.
- Pancreatic cancer.
- Liver cancer.

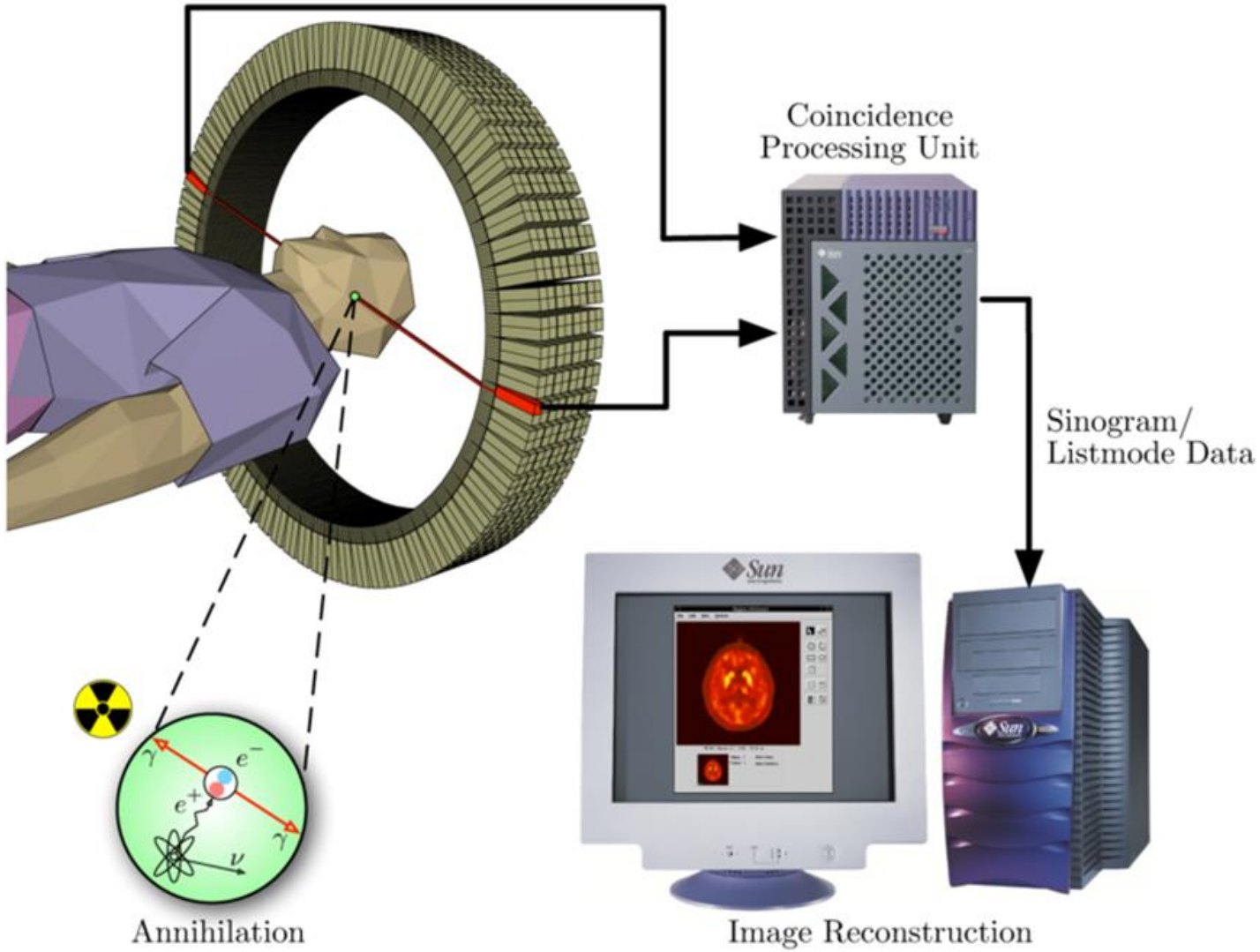
Treatment

- When DNA changes cause malignant (cancerous) cells to grow along the gastrointestinal tract
- Symptoms vary depending on the type of gastrointestinal cancer
- Treatments include surgery, chemotherapy, radiation therapy immunotherapy, targeted therapy
- Involves Gastrointestinal Cancers Program

Why go for a full-body PET Scan?

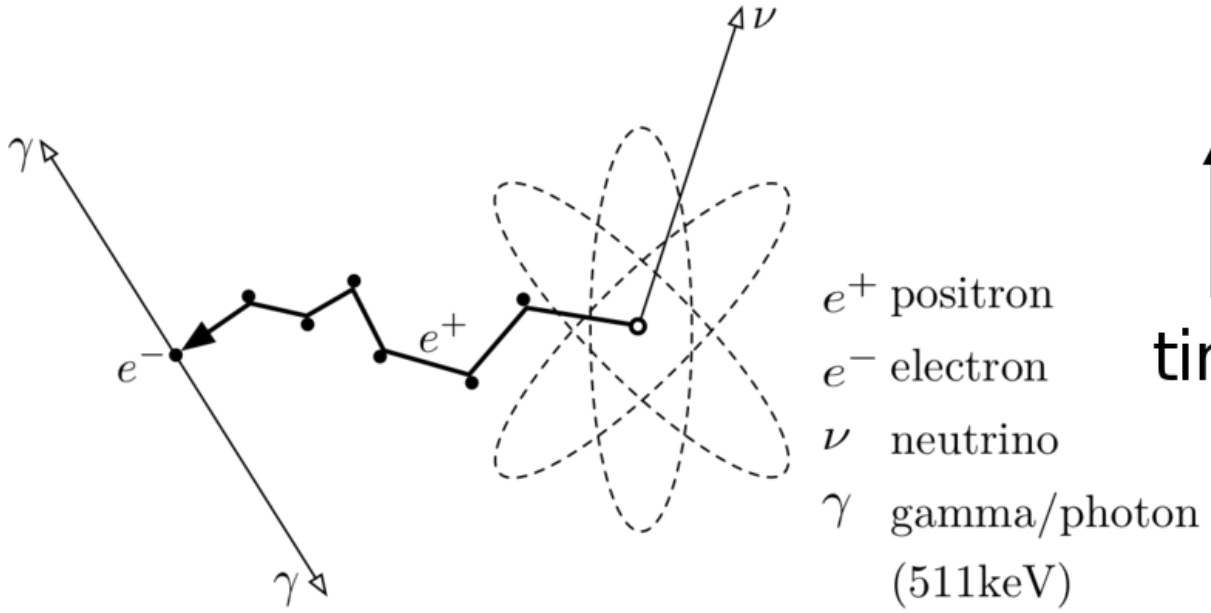
- Helps the doctors in deciding a more targeted treatment plan and monitoring the given treatment or medication.
- It is non-invasive, harmless, painless, and the most comfortable technique.
- Reduces the number of scanning sessions a patient would otherwise require, to get each organ or body part diagnosed.
- Less time-consuming as compared to some tests that require 2-3 visits on average.
- Track most diseases at an early stage,
- In cases like cancer, it can determine the stage, where it has spread, and whether it is operable or not.
- It can check for tumor development in any part of the tissue or organs.

PET radiopharmaceuticals

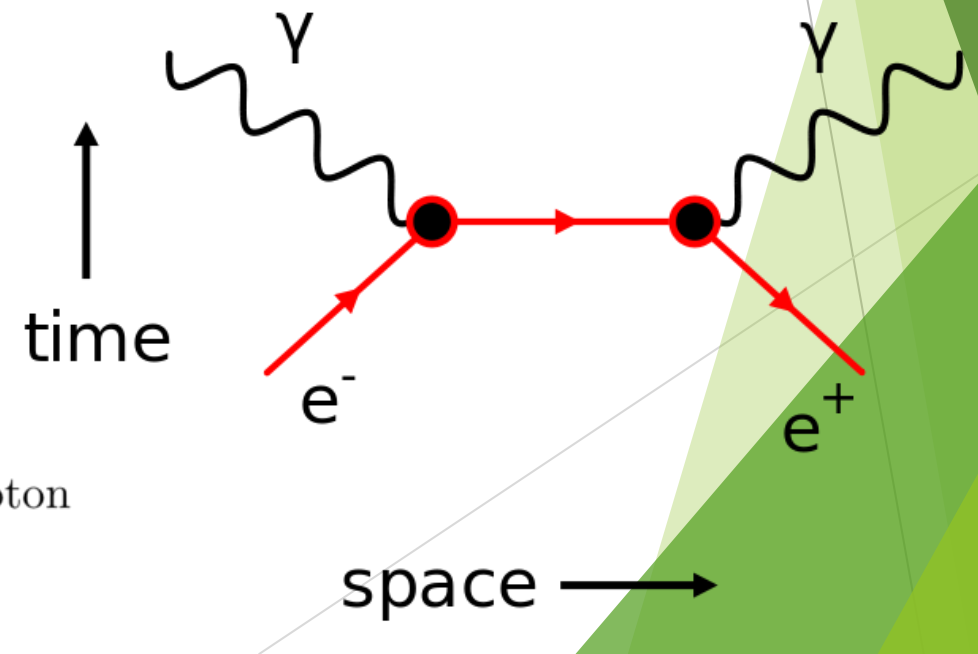


Electron–positron annihilation

- **Electron–positron annihilation occurs when an electron (e−) and a positron (e+, the electron's antiparticle) collide. The result of the collision is the annihilation of the electron and positron, and the creation of gamma ray photons or, at higher energies, other particles:**



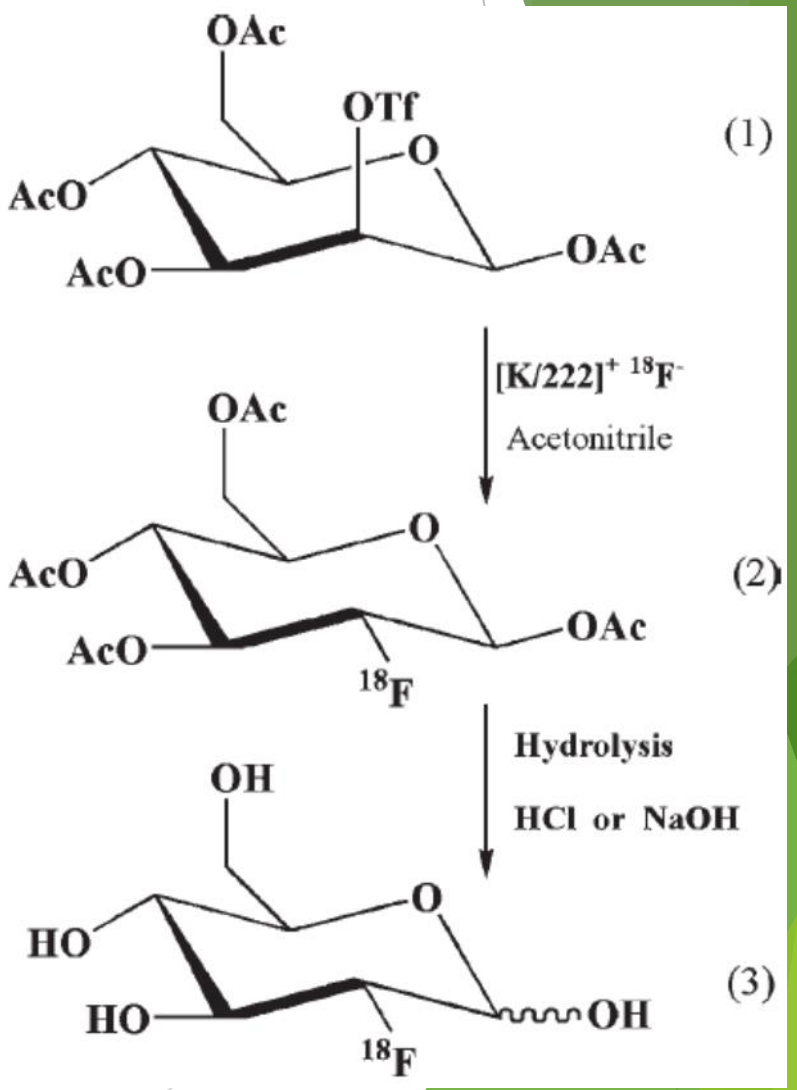
e^+ positron
e^- electron
ν neutrino
γ gamma/photon (511keV)



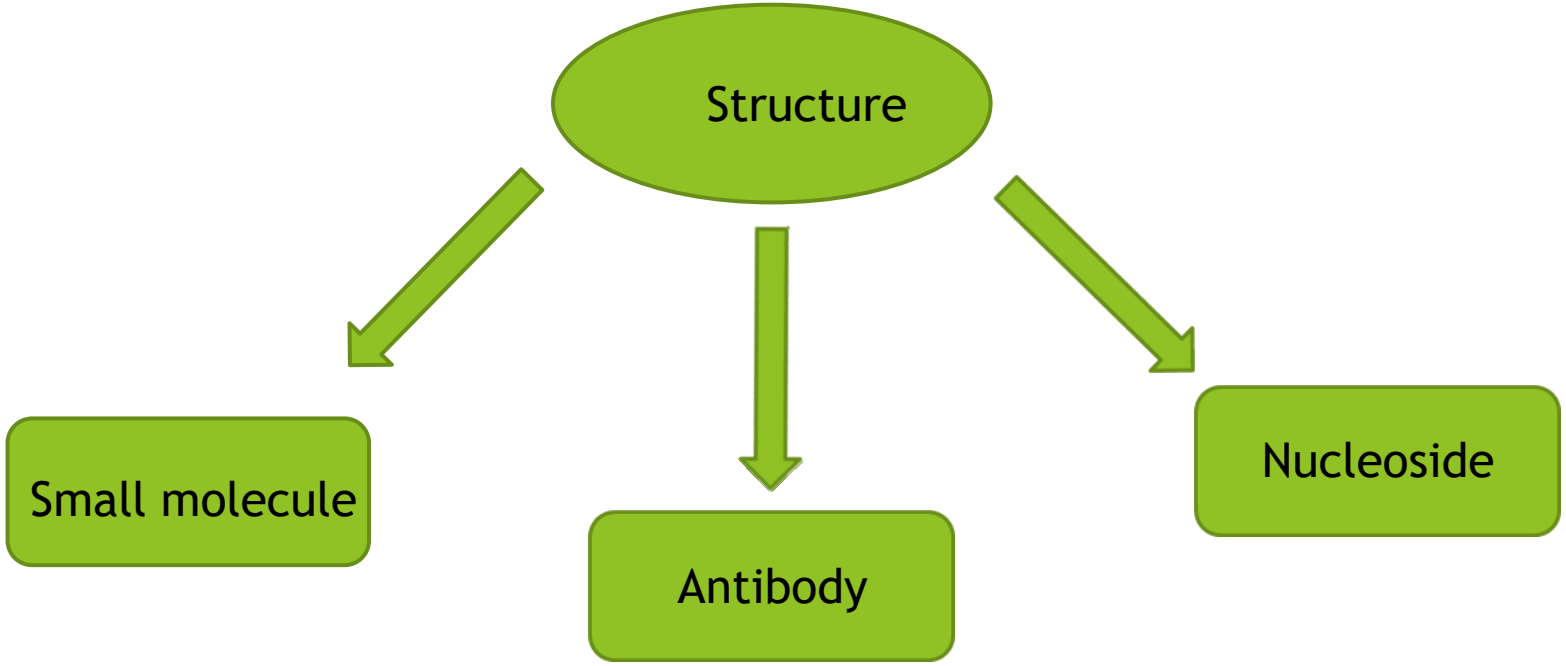
Isotope	Halflife	fraction Max.	Energy range(mm)	production
C-11	20.4 mins	0.99 0.96 MeV	0.4 mm	cyclotron
N-13	9.96 mins	1.00 1.20 MeV	0.7 mm	cyclotron
O-15	123 secs	1.00 1.74 MeV	1.1 mm	cyclotron
F-18	110 mins	0.97 0.63 MeV	0.3 mm	cyclotron
Cu-62	9.74 mins	0.98 2.93 MeV	2.7 mm	generator
Cu-64	12.7 hours	0.19 0.65 MeV	0.3 mm	cyclotron
Ga-68	68.3 mins	0.88 1.83 MeV	1.2 mm	generator
Br-76	16.1 hours	1.00 1.90 MeV	1.2 mm	cyclotron
Rb-82	78 secs	0.96 3.15 MeV	2.8 mm	generator
I-124	4.18 days	0.22 1.50 MeV	0.9 mm	cyclotron

18F-FDG

- **18F-FDG as common PET radiopharmaceutical for diagnosis of cancerous cells as well as GI malignancies**



Other PET radiopharmaceuticals for GI malignancies detection



Radiopharmaceuticals based on antibody

Biological process/ Target	Radiopharmaceutical	Indication
A33	[124I]I-huA33	Colorectal cancer
Carcinoembryonic antigen (CEA)	[89Zr]Zr-AMG [1]	Gastrointestinal, adenocarcinoma
Epidermal growth factor receptor(EGFR)	[89Zr]Zr-Cetuximab	Nonsmall cell lung carcinoma, Colorectal cancer
	[89Zr]Zr-Panitumumab	

1:Bi-specific T-cell engagers (BiTEs) are a class of artificial bispecific monoclonal antibodies that are investigated for use as anti-cancer drugs.

Radiopharmaceuticals based on Small molecules

Biological process/ Target	Radiopharmaceutical	Indication
Epidermal growth factor receptor(EGFR)	[11C]erlotinib	Nonsmall cell lung carcinoma, Colorectal cancer
	[11C]PD153035	
	[18F]afatinib	

Radiopharmaceuticals based on Nucleoside

Biological process/ Target	Radiopharmaceutical	Indication
Thymidine kinase(DNA replication)	[18F]-FLT	Solid malignancies