^{90}Y PET/CT & SPECT/CT and corresponding contours dataset

Patient Y90S1P26

Acknowledgement Request for Published Use:

We ask that anyone using this data for publications/presentations acknowledge this as follows:

"We acknowledge Yuni Dewaraja at the University of Michigan for providing access to Y-90 patient imaging data and segmentations obtained with support from RO1 EB022075 awarded by NIBIB. Data were shared via the University of Michigan Deep Blue data sharing repository."

Introduction:

Interest in quantitative imaging of Y-90 is growing because transarterial radioembolization (RE) with Y-90 loaded microspheres is a promising and minimally invasive treatment that is FDA approved for unresectable primary and metastatic liver tumors. These cancers are a leading cause of cancer mortality and morbidity. Radioembolization is a therapy that irradiates liver tumors with radioactive microspheres administered through a microcatheter placed in the hepatic arterial vasculature. Radioembolization is based on the principle that healthy liver and tumor are mainly vascularized by the portal vein and the hepatic artery respectively. As a result, radioactive microspheres are preferentially located in the lesions after they are administered via the hepatic artery.

File Descriptions:

Files are stored using the DICOM standard widely accepted for storage and transmission of medical images and related information. All patient private information has been anonymized using MIM commercial software (MIM Software Inc.).

Three sets of imaging data have been provided for each patient. 1) A post therapy Y-90 PET/CT scan, 2) a post-therapy Y-90 SPECT/CT scan, 3) a pre-therapy Tc-99m MAA SPECT/CT scan. Additionally, there is a structure set associated with each of the CTs above with contours of the relevant tumor/organ boundaries. All tumor contours have been manually labeled on CT by a radiologist and liver contours have been labelled using semi-automatic tools by a technologist.

Information on scan data/time, acquisition time, matrix size, pixel size, reconstruction method/parameters etc. are available on the DICOM header of these files. Only Personal Health Information (PHI) were removed during the anonymization.

Below is some additional information:

Y90 PET/CT:

Scanner: Siemens Biograph mCT with TOF
Reconstruction: Siemens OSEM (see DICOM header for information)
Note: Injected Y90 activity/time on the DICOM header is incorrect. This will impact SUV only. Please see below for injected activity/time

Y90 Bremsstrahlung SPECT/CT:

Scanner: Siemens Symbia or Intevo with 5/8" crystal and HE collimator
Reconstruction: Siemens Flash3D without scatter correction. See DICOM header for details

Tc-99m SPECT/CT:

Scanner: Siemens Symbia or Intevo with 5/8" crystal and LEHR collimator
Reconstruction: Siemens Flash3D. See DICOM header for details

Contours:

There are 3 sets of lesion and liver contour files, each associated with one of the above CTs. The following contours are present in each file:

LIVER: Organ outline of entire liver
Lesion1 rt ant sup: 9.38 ml tumoral lesion
Lesion2 rt ant lat: 4.4 ml tumoral lesion
Lesion3 rt post: 5.45 ml tumoral lesion
Lesion4 rt ant inf: 1.77 ml tumoral lesion

Additional Information:

Y90 Injected Activity: 2.9 GBq
Y90 Time/date of Injection: 25MAY2017 5:08 PM

Both Y-90 PET/CT and Y90 SPECT/CT are performed on the day of radioembolization and typically within 1 – 3 hours after the procedure (see DIICOM header for scan time)

Tc-99m injected Activity: Approximately 5 mCi
Tc-99m Time/date of injection: Not recorded but is typically within 1 – 2 hours before the scan

Our publications related to above data that may have additional information you are looking for are listed below. However, note that in some cases in-house developed algorithms were used for reconstruction while all images in this repository were reconstructed using clinic software.

1. Dewaraja YK, Chun SY, Srinivasa RN, Kaza RK, Cuneo KC, Majdalany BS, Novelli PM, Ljungberg M, Fessler JA. Improved quantitative (90) Y bremsstrahlung SPECT/CT reconstruction with Monte Carlo scatter modeling. Med Phys. 2017;44(12):6364-6376.

2. Lim H, Fessler JA, Wilderman SJ, Brooks AF, Dewaraja YK. Y-90 SPECT ML image reconstruction with a new model for tissue-dependent bremsstrahlung production using CT information: a proof-of-concept study. Phys Med Biol. 2018, 22;63(11):115001. doi: 10.1088/1361-6560/aac1ad.

3. Allred JD, Niedbala J, Mikell J, Owen D, Frey KA, Dewaraja YK. The value of 99mTc-MAA SPECT/CT for lung shunt estimation in 90Y radioembolization: a phantom and patient study. EJNMMI Research. 2018, 15;8(1):50. doi:10.1186/s13550-018-0402-8.

4. Mikell JK, Kaza RK, Roberson PL, Younge KC, Srinivasa RN, Majdalany BS, Cuneo KC, Owen D, Devasia T, Schipper MJ, Dewaraja YK. Impact of (90)Y PET gradient-based tumor segmentation on voxel-level dosimetry in liver radioembolization. EJNMMI Phys. 2018 Nov 30;5(1):31. doi:

   10.1186/s40658-018-0230-y.

5. Mikell JK, Majdalany BS, Owen D, Paradis KC, Dewaraja YK. Assessing Spatial Concordance Between Theranostic Pairs Using Phantom and Patient-Specific Acceptance Criteria: Application to (99m)Tc-MAA SPECT/(90)Y-Microsphere PET. Int J Radiat Oncol Biol Phys. 2019 Aug 1;104(5):1133-1140.

6. Dewaraja YK, Devasia T, Kaza RK, Mikell JK, Owen D, Roberson PL, Schipper MJ. Prediction of Tumor Control in (90)Y Radioembolization by Logit Models with PET/CT-Based Dose Metrics. J Nucl Med. 2020;61:104-111.

7. S. Y. Chun, M. P. Nguyen, T. Q. Phan, H. Kim, J. A. Fessler and Y. K. Dewaraja, "Algorithms and Analyses for Joint Spectral Image Reconstruction in Y-90 Bremsstrahlung SPECT," in *IEEE Transactions on Medical Imaging*, vol. 39, no. 5, pp. 1369-1379, May 2020, doi: 10.1109/TMI.2019.2949068.

8. Xiang, H., Lim, H., Fessler, J.A. *et al.* A deep neural network for fast and accurate scatter estimation in quantitative SPECT/CT under challenging scatter conditions. *Eur J Nucl Med Mol Imaging* (2020). https://doi.org/10.1007/s00259-020-04840-9

9. Lim H, Chun IY, Dewaraja YK, Fessler JA. Improved low-count quantitative PET reconstruction with a variational neural network. IEEE Trans Med Imag 2020 (accepted) https://arxiv.org/abs/1906.02327

10. Wei L, Cui C, Xu J, Kaza R, El Naqa I, Dewaraja YK. Tumor Response Prediction in 90Y Radioembolization with PET-based Radiomics Features and Absorbed Dose Metrics. European Journal of Nuclear Medicine and Molecular Imaging Physics 2020 (submitted)