Theranostics in SPECT/CT imaging

$^{177}$Lu case highlights
Highlighted cases

Metastatic NET

Three-time-point study post-therapy

Single-time-point study

Images courtesy of Royal North Shore Hospital, Sydney, Australia, CHUV, Nuclear Medicine, Lausanne, Switzerland, and Prof. Buck, University Hospital of Würzburg, Würzburg, Germany.
Sequential xSPECT Quant study following therapeutic administration of 7.5GBq $^{177}$Lu DOTATATE in metastatic NET

Neuroendocrine tumor (NET) with extensive liver involvement underwent peptide receptor radionuclide therapy (PRRT) with 7.5 GBq of $^{177}$Lu DOTATATE. Sequential xSPECT Quant™ study enabled accurate quantification of tracer concentration for evaluation of tumor and critical organ absorbed dose.

Click here to read case 1
Sequential xSPECT Quant study following therapeutic administration of 7.5GBq $^{177}$Lu DOTATATE in metastatic NET

Mean: 0.8 MBq/ml

Mean: 1.2 MBq/ml

Mean: 1.3 MBq/ml

Mean: 0.6 MBq/ml

0.5-hours post-injection

4-hours post-injection

24-hours post-injection

120-hours post-injection

xSPECT Quant is not commercially available in some countries. Due to regulatory reasons, its future availability cannot be guaranteed. Please contact your local Siemens organization for further details. Data courtesy of Royal North Shore Hospital, Sydney, Australia.
Sequential xSPECT Quant study following therapeutic administration of 7.5GBq $^{177}$Lu DOTATATE in metastatic NET

Mean: 1.75 MBq/ml
Mean: 0.78 MBq/ml
Mean: 0.49 MBq/ml
Mean: 0.14 MBq/ml

0.5-hours post-injection
4-hours post-injection
24-hours post-injection
120-hours post-injection

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Tumor and renal dose estimation from sequential xSPECT Quant study following 7.5GBq $^{177}$Lu DOTATATE therapy

Time activity curves

Dose volume curve: tumor

Dose volume curve: left kidney

<table>
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<tr>
<th>MIRD Organ Dose (Gy)</th>
<th>MC Based Organ Dose (Gy)</th>
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<tbody>
<tr>
<td>Liver</td>
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<td>Spleen</td>
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<td>Hot Tumor 1</td>
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Tumor and renal dose estimation from sequential xSPECT Quant study following 7.5GBq $^{177}$Lu DOTATATE therapy

**History**

49-year-old male with metastatic neuroendocrine tumor with extensive liver involvement underwent peptide receptor radionuclide therapy (PRRT) with 7.5 GBq of $^{177}$Lu DOTATATE. Sequential SPECT/CT studies using xSPECT Quant™ were performed at 0.5 hours, 4 hours, 24 hours, and 120 hours following therapy administration. Sequential SPECT/CT datasets were aligned and automated segmentation was performed to delineated tumor and critical organ volumes and tracer concentration within individual volumes generated by xSPECT Quant. Volume and tracer concentration information were subsequently used by research dosimetry software to generate time activity curves, bi-exponential fit, and tumor and critical organ absorbed dose estimates.

**Diagnosis**

Sequential images visualize multiple liver metastases, which show gradual increase in tracer uptake with peak activity at 24 hours post administration with slow washout. Both kidneys; however, show normal initial cortical and pellucal uptake with fast washout. Dosimetry calculations show high dose to functioning tumor with one tumor segment dose estimated at 22.3 Gy; whereas renal dose was within expected levels (left kidney dose 3.73 Gy), which suggested potential for additional therapies without compromising renal function.

**Protocol**

Symbia Intevo™ 6 7.5 GBq $^{177}$Lu DOTATATE inj; 0.5 hr, 4 hrs, 24 hrs, and 120 hrs post-injection SPECT/CT acquisition CT: 130 kV, 27 eff mAs. 64 x 1 mm collimation, SPECT: 60 stops per detector 20 sec/stop xSPECT Quant reconstruction.
Three-time-point xSPECT Quant study post $^{177}$Lu DOTATATE therapy defines time activity curves for renal dosimetry

A 70-year-old female with liver metastases from neuroendocrine tumor underwent peptide receptor radionuclide therapy (PRRT) with 6.3 GBq of $^{177}$Lu DOTATATE.
Three-time-point xSPECT Quant study post $^{177}$Lu DOTATATE therapy defines time activity curves for renal dosimetry

- Mean: 248.42 kBq/ml (2-hour post-injection)
- Mean: 265.74 kBq/ml (24-hour post-injection)
- Mean: 236.50 kBq/ml (48-hour post-injection)

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xSPECT Quant is not commercially available in some countries. Due to regulatory reasons, its future availability cannot be guaranteed. Please contact your local Siemens organization for further details. Data courtesy of CHUV, Nuclear Medicine, Lausanne, Switzerland.
A 70-year-old female with liver metastases from a neuroendocrine tumor underwent peptide receptor radionuclide therapy (PRRT) with 6.3 GBq of $^{177}$Lu DOTATATE. xSPECT Quant™ studies were acquired on a Symbia Intevo™ SPECT/CT at 2, 24, and 48 hours post-injection.

Sequential xSPECT Quant studies show focal uptake of tracer in the solitary liver metastases. Visual evaluation, as well as absolute quantification of tracer uptake in the metastases, shows mild increase in tracer concentration in metastases after 24 hours with slow washout. Both kidneys show normal cortical uptake with gradual clearance of tracer with right renal SUV mean of 3.20 at 2 hours, decreasing to 2.72 at 48 hours. Renal volume and total tracer concentration at 3 time points calculated from xSPECT Quant data was used to define time activity curves for renal dosimetry, which was calculated to be 2.3 Gy. This was within expected normal limits.

**Protocol**

Symbia Intevo, 170 mCi [6.3 GBq] $^{177}$Lu DOTATATE, 2-, 24-, and 48-hour post-injection delay CT: 130 kV, 30 mAs.

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177Lu xSPECT Quant enables quantification in PRRT
SAFIRE reduces dose and image noise

A patient with advanced neuroendocrine tumor of the pancreas was referred for the fourth cycle of peptide receptor radionuclide therapy (PRRT). SAFIRE images used for attenuation correction.

SAFIRE is optional on Symbia Intevo Bold. In clinical practice, the use of SAFIRE may reduce CT patient dose depending on the clinical task, patient size, anatomical location, and clinical practice. A consultation with a radiologist and a physicist should be made to determine the appropriate dose to obtain diagnostic image quality for the for the particular clinical task. Data on file. Symbia Intevo Bold and xSPECT Quant are not commercially available in some countries. Due to regulatory reasons, their future availability cannot be guaranteed. Please contact your local Siemens organization for further details.

Data courtesy of Prof. Buck, University Hospital of Würzburg, Würzburg, Germany.
Lu xSPECT Quant enables quantification in PRRT
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**177Lu xSPECT Quant enables quantification in PRRT**

**SAFIRE reduces dose and image noise**

**History**
A 49-year-old patient with an advanced pancreatic neuroendocrine tumor, initial staging cT4 cNx cM1(HEP) was referred for a fourth cycle of peptide receptor radionuclide therapy (PRRT) with 4.1 GBq $^{177}$Lu-somatostatin-receptor (SSTR)-targeting ligand.

**Diagnosis**
A 22-hour post-injection xSPECT Quant™ scan showed heterogeneous tracer uptake in the known primary tumor of the pancreas, as well as focal uptake in the hepatic metastases. xSPECT Quant enabled the quantification of the uptake for further evaluation and comparability to treatment cycles in the future. SAFIRE helped to significantly reduce the noise in the CT image while using low-dose protocols.

**Protocol**
Symbia Intevo Bold™ SPECT/CT 16, 111 mCi [4.1 GBq] $^{177}$Lu-SSTR ligand, 22-hour post-injection delay. Images reconstructed with xSPECT Quant, 256 x 256 matrix size, CT: DLP 116 mGy*cm, 42 mAs, 110 kV.

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Data courtesy of Prof. Buck, University Hospital of Würzburg, Würzburg, Germany.

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