

# Biograph mCT Enhances Radiation Therapy Planning

Quickly integrating research into clinical practice is not the norm across the globe, but it is a hallmark of medical practice at Rigshospitalet–Copenhagen University Hospital in Denmark.

By Coleen Curran

In radiation treatment planning at Rigshospitalet, cutting-edge research is finding its way into the clinical arena through a team approach among radiology, nuclear medicine and radiation oncology that puts the focus directly on patient care. Rigs Department of Radiotherapy completes about 5,000 PET•CT scans a year, 1,000 of which are for radiation treatment planning. Multidisciplinary physicians look at images together to come up with the best treatment plan for each patient. Today, Rigs PET and Cyclotron Unit houses four Siemens PET•CT scanners, one of which is used exclusively for radiotherapy planning. Siemens Biograph™ mCT with its 78 cm bore is ideal for radiation treatment planning, says Anne Kiil Berthelsen, MD, a radiologist at the facility. “Because the bore is

so large, it’s easier to place a patient in the fixation system,” she says. “It’s not easy for patients with head and neck cancer to be lying for an extended period of time in the fixation system, so it means a lot to the patients that the system is much faster, too.” Faster PET•CT scans also can result in better accuracy since the less time patients are required to be still, the more likely they are able to comply. Berthelsen joined Rigshospitalet a decade ago when it acquired its first PET/CT scanner for radiation therapy planning. Since then, she has been performing clinical research and providing advice for treating patients. The small bore opening and slow scanning speed of their first PET/CT proved difficult for patients who were uncomfortably confined for long periods by the treatment

planning fixation system. Today, the team at Rigs uses its Biograph mCT to develop approximately 1,000 radiation treatment plans a year for patients with lymphomas, cervical cancer, rectal and anal cancer, cancers of the head and neck and some more routine cancers. A whole-body PET•CT scan on Biograph mCT takes about five minutes—which is 50 to 100 percent less time than other treatment planning scanners. “We especially like to use it because it’s faster for children,” Berthelsen says. PET•CT images are read by both a nuclear medicine physician and a radiologist, and then nuclear medicine completes the tumor delineation. The tumor delineation is then sent to the main Varian Eclipse™ radiotherapy system. “We work very closely with nuclear medicine,” Berthelsen says. “We look at all



## Facility Snapshot

- 60 people work in the PET unit including technologists and physicians
- 14 linear accelerators
- 4 PET•CT scanners
- 5,000 PET•CT scans annually (1,000 of them for radiation treatment planning)



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Anne Kiil Berthelsen, MD,  
Rigshospitalet-Copenhagen University Hospital, Copenhagen, Denmark

the scans together. We fuse the scans together. We don’t do it as a radiology department and as a nuclear medicine department separately, we do all treatment planning together.”

“It all works very well,” she says. “We have a daily routine, and the Siemens PET•CT system works very well with the Varian systems.”

Physicist and Computer Scientist Flemming Littrup Andersen, PhD, who facilitates all of the data handling, agrees. The nuclear medicine physicians complete the tumor delineation via PET and then send the delineated tumor in DICOM RT format to the radiation therapy department along with the CT. “We do [tumor] contouring on the Biograph mCT, and we only export the contours to the radiotherapy system,” Andersen says. “We are the experts at deciding if something shows up on the PET•CT, such as a malignant tumor or uptake in some infection or muscle. Our physicians are the experts in deciding if this is tumor tissue or not. That’s why we do the delineation of the contouring. Then we send that over to treatment planning. They are experts in deciding what to treat.

“We have the oncologist and the radiologist look at the CT and planning information from the tumor,” Andersen says. When it comes to next-generation software, Flemming is the point person for the hospital. He talks regularly with Siemens about what works well and how it can be further refined and helpful. “Of course, the Biograph mCT’s high-resolution [images] lead to better radiation treatment, so you radiate as little as pos-

sible,” he says. “Moving more in that direction is beneficial as are developing more tools to eliminate breath artifacts, especially for tumors of the lung, new tracers that help visualize functions and more automatic procedures to help with contouring.”

Because of the Biograph mCT’s faster scanning speed, radiologists at Rigs are doing breath-hold scanning with young lymphoma patients and some lung cancer patients to try and spare lung and other healthy tissue, Berthelsen explains.

Oncologists and radiologists work together on tumor delineation. “It’s very precise,” Berthelsen says. “We see lymph nodes that we never could see before. The oncologists are very satisfied. Once they have the planning PET•CT scans, they can start radiation treatment just one week later. It’s very quick.”

Oncologist Lena Specht, MD, agrees. “It’s crucial to contour all the tumor tissue and define it correctly since we shape the dosage to what is on the treatment plan,” she says.

Specht notes that the Rigs’ team pivotal research in conjunction with the excellent treatment planning images has resulted in changes to the treatment field in about one-third of cases involving lymphomas and head and neck cancers. “More precise planning results in more effective treatment of diseased tissue and better preservation of healthy tissue,” Specht says.

In one research project, Berthelsen notes, the team found that PET•CT allows for more precise tumor delineation, and it also creates a smaller varia-

tion in treatment from one oncologist to another because oncologists feel more secure about the accuracy of the PET•CT RT planning scans.

For example, the primary tumor in head and neck cancers can be very difficult to see on a CT scan, and may be imaged using MR in addition to PET•CT. “We would fuse the MR image with the PET•CT image to get the truest picture of the tumor delineation,” Berthelsen says. “When you look just at a CT scan, we say that a lymph node smaller than 1 cm is not malignant; but then you see a PET•CT of that lymph node with high uptake and you know it’s malignant. [PET•CT] makes it easier to see uptake and how malignant a tumor is [based on uptake]. It makes it easier to see if the borders of the tumor are benign or malignant.”

### PET•CT Treatment Planning Changes Care Plans

In at least 15 percent of the patients, Berthelsen notes that PET•CT treatment planning turns up more disease than initially diagnosed. In these instances, the radiation dose may be changed to palliative or, in some cases, chemotherapy may be added.

“So that’s 15 percent of patients whose treatment plans change as a result of the PET•CT images,” Berthelsen says. “I’ve been doing it for 20 years now, and it’s very interesting work. I’m very proud of the job we’re doing. It really is a team effort to do the best we can for each patient.”

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