



Integrated CT data guides stenting procedures

Mapping vessels with low-dose CT

Who/where

- Martin Hoffmann, MD, University Clinic Ulm, Germany.
- Prof. Philippe Charles Douek, Hopital L. Pradel, University of Lyon, France.
- Prof. Klaus Hergan, County Hospital Salzburg, Austria.
- Prof. Ralph Haberl, Clinic Munich-Pasing, Munich, Germany.

Challenge

- Reducing the dose in order to use cardiac CT for diagnostic purposes
- Making CT data available for cardiologists to guide interventions

Solution

- Philips CT Brilliance 64-channel scanner with Step & Shoot Cardiac application
- Integration of CT data in the cath lab with Philips CT TrueView

Computed tomography of the heart (cardiac CT) is already well accepted as a non-invasive imaging technique in specific patient populations, and has been found to accurately map out the entire coronary tree.

The acquisition technique which has hitherto been used has, however, had the disadvantage of a higher radiation dose compared with examinations in the catheterization lab (cath lab). Taking advantage of technological innovations, Philips has developed a low-dose alternative for cardiac imaging called Step & Shoot. Preliminary studies with the Philips Brilliance CT 64 channel scanner have shown that with appropriate patient selection and preparation, Step & Shoot can provide excellent image quality while reducing the effective radiation dose down to an average of 3.5 mSv. If the CT scan shows that a patient's condition necessitates an interventional procedure, the radiologist can provide the cardiologist with CT data before stenting. Another Philips invention, CT TrueView, seamlessly integrates CT data into the cath lab to help the cardiologist guide the intervention. The results are not only a reduced procedure time but also better quality results of the intervention. In close collaboration with Philips, four hospitals across Europe have been pioneering the latest advancements in computed tomography.

Diagnosing with a lower dose

Until recently, clinicians would typically use retrospectively spiral scanning modes in CT for coronary artery disease detection. While overlapping data helped ensure consistent reconstruction, the downside was a high radiation dosage. Step & Shoot Cardiac works in a prospective axial scanning mode: In this electrocardiogram-gated scanning mode x-rays will only be turned on during the physiologic phase of interest, reducing the radiation dose for the patient.

Martin Hoffmann, MD, from the University Clinic Ulm in Germany, has already diagnosed approximately 60 patients using a Brilliance CT 64-channel scanner with the new scanning technique for Cardiac CT.



University Clinic Ulm: Reducing radiation with CT Step & Shoot

PHILIPS



Martin Hoffmann, MD: "For the first time I can scan female patients with a clear conscience."

"With Step & Shoot, we have gone from 15mSv with conventional CT applications to incredibly low 3mSv, which is no more than the average annual background radiation exposure," the radiologist reports. While he does not use the technology for diagnosing severely ill or high-risk patients, he finds it very useful in the typical 50-year-old patient with unclear cardiac symptoms. A stable heart beat of 65 beats per minute or less is required for examining a patient with Step & Shoot and the technique also requires accurate prediction of the patient's cardiac cycle. If the heart rate is stable, Step & Shoot requires no more contrast agent than the conventional CT scan.

Enlarging the group of patients

Martin Hoffmann has found that the new technology not only reduces the radiation dose for many patients but it also allows cardiac CT exams to be offered to an entirely new group of patients who were formerly excluded: "I have always hesitated to use Cardiac CT on women as breast tissue is very sensitive to radiation," reflects Martin Hoffmann. Thanks to Step & Shoot, I can scan female patients with a clear conscience for the very first time."

The University of Lyon in France also uses cardiac CT with Step & Shoot in children over 10 years of age to evaluate the coronary arteries and to explore congenital heart diseases. "Step & Shoot allows for a 70% dose reduction with high-quality images," says Prof. Philippe Charles Douek. "It is a robust technique for patients with a regular rhythm below 65 beats per minute." The application can be used for bypass graft control or combined aorta and coronary examinations. At the Hopital L. Pradel, University of Lyon, Step & Shoot is already applied in one third of all cardiac CT examinations.

High-quality imaging

The University Clinic Ulm recently examined 20 patients using Step & Shoot and another 20 patients with the conventional helical CT. Despite the low dose in Step & Shoot, the diagnostic imaging quality was just as excellent as with conventional imaging. With Step & Shoot, images are reconstructed more quickly than with spiral retrospective scans. The built-in edge correction algorithm helps minimize artifacts, resulting from imaging at various physiological phases of the heart.

Prof. Philippe Charles Douek: "Step & Shoot allows for a 70% dose reduction with high-quality images."



"Step & Shoot is a very important step away from the conventional spiral," says Martin Hoffmann. "It can even help patients get away from the diagnostic loop with stress ECG and cath lab by using the CT scan as the first filter to detect or exclude a coronary artery disease."

"We have gone from 15mSv with conventional CT applications to incredibly low 3mSv with Step & Shoot."

Martin Hoffmann, MD

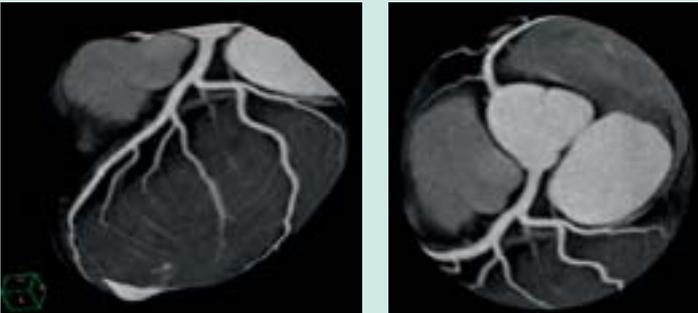
Excellent image quality with Brilliance CT at the Salzburg County Hospital



Showcase: Ruling out coronary artery disease with Step & Shoot

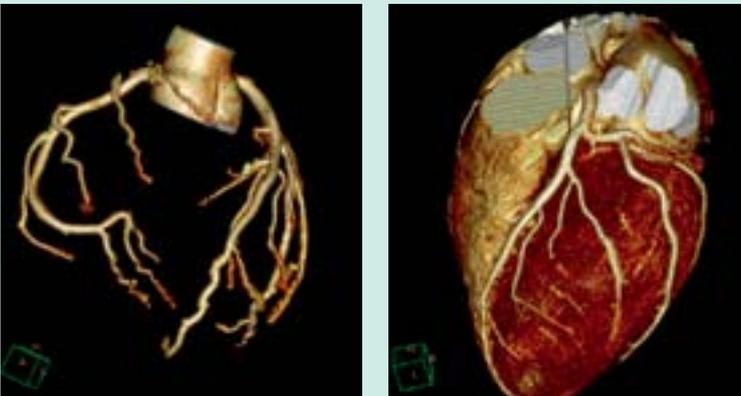
42-year-old male

- Intermittent chest cramping
- No risk factors
- Stress-ECG indicated coronary artery disease



Step & Shoot data acquisition

- Total dose exposure of 3,7mSv
- Total amount of contrast 90 ml at 6 ml/s
- Contrast agent Imeron 400 mg/ml
- BMI of the patient 23, mean heart rate 59/min



Results

- Excellent image quality with a reconstruction window located at 75% of the cardiac cycle
- The patient had normal coronaries without any plaque lesion discernible

Source: University Clinic Ulm, Martin Hoffmann, MD

Visualizing vessels at the push of a button

Prof. Klaus Hergan and his team at the County Hospital Salzburg, Austria, perform approximately 20,000 CT exams per year. For cardiac exams, they use a Philips Brilliance CT scanner to visualize vessels quickly and easily with Comprehensive Cardiac Analysis (CCA) and CT TrueView. “The cardiac analysis is conducted at the push of a button,” says Prof. Hergan. “We use 3D mode in many cases, especially for bypass diagnostics, but we also use the 2D map mode. With CCA and CT TrueView, we can see very clearly where the vessels run, even in complex cases.”

The CCA application provides entire coronary tree visualization, ventricular functional analysis, 3-D heart chamber as well as valve morphology. CT TrueView uses this 3-D CT segmentation to select and visualize the best 2-D C-arm projections for planning percutaneous coronary interventional (PCI) procedures, such as stent placement for bifurcations and chronic total occlusions.



Salzburg County Hospital: Pioneering cardiac CT



Prof. Klaus Hergan:
“Additional CT data
is beneficial for
the patient.”

“I’m sure that in ten years’ time,
it will be standard practice
to have a CT scan taken
before stenting.”

Prof. Klaus Hergan

Performing CT scans before stenting

At a congress on interdisciplinary cardiac diagnostics held recently at the hospital, Prof Hergan showed a live case with CCA and CT TrueView. The patient had a complex cardiac case and the participants – radiologists and cardiologists – were astonished by the wealth of additional information. “We are radiologists but we now provide additional information for the interventional cardiologist on a regular basis, so we have started looking at the patient in the same way as the cardiologist,” says Prof. Hergan. “For many of our colleagues this has been an eye-opener. I’m sure that in ten years’ time, it will be standard practice to have a CT scan taken before stenting.”

Prof. Hergan is delighted with the excellent cooperation between radiology and cardiology at the hospital. “Because the cardiologists receive a lot of additional information from the radiology department, they are very keen on having a CT scan taken before the intervention,” sums up Prof. Hergan. “The additional CT data in the cath lab not only improves the workflow, it’s also highly beneficial for the patient.”

Planning stenting procedures at the Salzburg County Hospital





Integrating CT data into the cath lab

At the Clinic Munich-Pasing, Germany, a Brilliance CT scanner is seamlessly integrated with the Philips Xcelera image management solution, importing images directly into the cath lab. CT TrueView facilitates the treatment process as the cardiologists can plan the intervention with additional CT data being provided automatically.

“CT TrueView has changed my view on cardiac CT,” says Prof. Ralph Haberl. “With any complex lesion, I now want to see the data from the CT scanner before the intervention - the more complex the case, the more useful the scan.” The hospital typically performs a high resolution scan the day before the intervention. With the help of the CT TrueView software, the cardiologists can identify the optimal projection angle with minimal shortening of the lesion and free insight without superposition of neighbouring coronary arteries. “We can clearly determine how long the obstructive lesion is,” adds Prof. Haberl. “What’s more, we can also see the plaque burden around a stenosis.”

The software also helps detect all side branches so that the cardiologist can fit the stent in between those side branches. “This is done long before the patient enters the cath lab,” explains Prof. Haberl. “The cath study is performed the next day and we can see the corresponding CT image in the very same projection of the actual C-arm position on a separate monitor in the cath lab.”

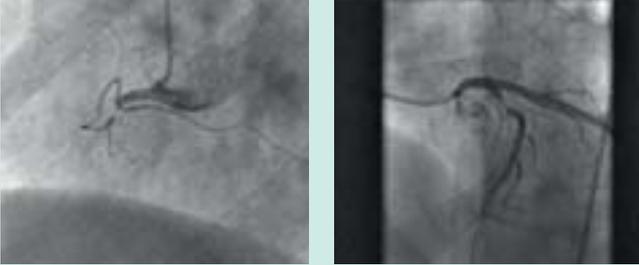
Improving stenting results

The additional information shortens procedure time, increasing the productivity of the cath lab, but it also increases the accuracy of stent placement. “Sometimes the CT data shows that we will need to use a longer stent than we would normally have used,” says Prof. Haberl. In these cases, the additional CT data in the cath lab improves the clinical outcome of the stenting procedure and helps keep patients healthier, longer. “CT TrueView is an intelligent implementation and it shows that Philips understands the discovery to balloon reality,” says Prof. Haberl. “This is an entirely new approach for interventional cardiology.”

Showcase: Planning intervention of artery blockage with CT TrueView

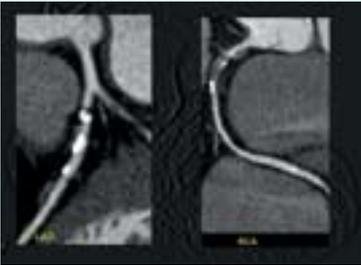
Cath lab results

Blocked right coronary artery



Additional CT information

Wall changes with thrombus, LAD with severe stenosis



Intervention planning

- Calculated optimal projections with CT TrueView
- Calculated length of stent with CT TrueView data



Source: Clinic Munich-Pasing, Prof. Ralph Haberl

"CT TrueView is an intelligent implementation and it shows that Philips understands the discovery to balloon reality."

Prof. Dr. med. Ralph Haberl



Prof. Dr. med. Ralph Haberl: "This is an entirely new approach for interventional cardiology."



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