

Live 3D needle guidance with XperGuide

High accuracy for needle interventions

Who/where

St. Antonius Hospital
Location: Nieuwegein, The Netherlands
Type: Training and teaching hospital
Beds: 584
Radiology: 160,000 radiology procedures per year. Interventions include balloon angioplasty, stenting, endograft placement (thoracic and abdominal), embolizations (PAVM in particular), biliary interventions and vertebroplasty
Specialties: Cardiac, vascular and lung diseases
Who: Marco van Strijen, interventional radiologist

Challenge

Accurately perform biopsies in the X-ray angio suite.

Solution

Use Philips XperCT for three-dimensional spatial clarity and Philips XperGuide for real-time, image-guided needle placement.

Dr. Marco van Strijen, interventional radiologist, reports on results from XperGuide, a live 3D guidance tool he is using for radiology interventions. High accuracy with less effort and higher patient comfort with less X-ray dose are his first impressions.

Experienced interventionalist

The St. Antonius Hospital is a leading specialist heart and lung center in The Netherlands. Dr. van Strijen works as an interventional radiologist and apart from vascular interventions specializes in biopsies and drainage procedures. Interventions have been steadily increasing in the last few years, and Dr. van Strijen is one of the facility's innovators in the use of three-dimensional interventional tools for these procedures.

“The typical length of our procedures with XperGuide is usually 30 to 35 minutes. With CT, we usually have to reserve an hour for the same procedure.”

Real-time 3D planning and guidance

Philips XperCT enables practitioners to acquire CT-like images right on the Allura Xper FD20 X-ray system in the interventional lab. These images can be used to plan, guide and evaluate the procedure in the exam room while the patient is still on the table. XperCT reconstructs 3D volumes from rotational runs. The acquired images (with or without contrast) are automatically reconstructed into an isotropic soft-tissue volume. These images are used to plan the virtual puncture path.

Once the Philips XperCT has been completed, Dr. van Strijen uses Philips XperGuide to assist him in proper needle placement. XperGuide shows the advancement of the needle in real-time based on his own user-defined trajectory. The live fluoroscopy image is superimposed on the XperCT pathology image to give him instant feedback on possible deviations and help him more confidently guide the needle along the correct puncture path. At the end of the examination, Dr. van Strijen performs another XperCT scan to check for complications.

PHILIPS



Today's practice for percutaneous needle interventions

Van Strijen explains that fluoroscopy, CT and ultrasound are currently used to support percutaneous needle interventions. However, these all have limitations. "Fluoroscopy shows live images of bones, but does not show soft tissue structures. CT is excellent for showing soft tissue structures, but you miss the live fluoroscopy capabilities on most standard CT scanners. CT fluoroscopy is possible but generates a higher X-ray dose compared to normal fluoroscopy. In addition, needle path planning can only be done in the axial plane and the choice of trajectories is limited by the working area within the gantry and the gantry tilt."

"It would take more effort using the CT scanner because you are constantly moving the patient in and out of the scanner."

With CT the patient has to be moved in and out of the CT scanner to check the needle progression and the gantry restricts access to the patient. Ultrasound has its limitations as well. "For soft tissue and kidneys, it is a good option, but in large patients you get a problem especially when you advance to deeper structures. The technique is observer dependant and you need to be a skilled and experienced user to get good ultrasound results."

More control through instant feedback

"Puncturing bone structures has an accuracy of within 3 millimeters. Soft tissue that is not moving has an accuracy within 5 millimeters. This is comparable or better to the accuracy we get with CT, but it would take a lot more effort using the CT scanner because you are constantly moving the patient in and out of the scanner."

Van Strijen finds XperGuide very accurate in working in areas that are not affected by breathing. "When you advance your needle and you are seeing at the same time the exact

position of the aorta and the renal vein and you know this is the point beyond which I should not go that is very useful. When I shoot the biopsy gun I know the tip will not exceed the exact final border of the puncture path."

"Another example is intra pulmonary procedures. So far we've done five cases and with XperGuide we can determine a puncture path. We didn't have one pneumothorax in any of these patients. We were able to get right through to the tumor without having to go through healthy lung tissue."

"You can use steep angles compared to CT or ultrasound."

Steeper angles

Philips XperGuide has offered other clinical advantages in the cases that Dr. van Strijen has performed. "You can use steep angles compared to CT or ultrasound. When we do sub-diaphragmatic procedures, I always take into account the actual movement of the diaphragm. One patient had a lesion all the way up in the adrenal. We needed a very steep angle (see figure 1). In cases with organ movements due to respiration, I wait each time until the diaphragm is in the exact same phase of the respiration to advance the needle, then wait, advance, wait, etc."

XperGuide 3D needle placement procedure, Dr. M. van Strijen



More room to work

“By performing interventions in the angio room, I have all the space I need to work. When I need more space between patient and detector, I simply rotate my C-arm and I can work in any position on top of the patient. In the CT gantry that is impossible since the CT gantry is always all around the patient.” Van Strijen says that it was very easy to learn how to operate the XperCT and XperGuide tools. “When you’ve performed ten cases you really know the system and can easily use it.”

“By performing my interventions in the angio room, I have all the space I need to work.”

Faster procedure, less X-ray dose

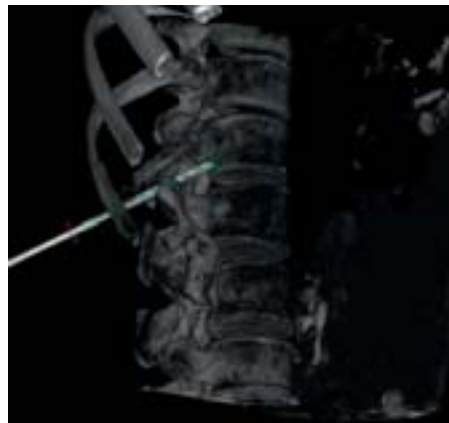
Biopsies can be carried out very quickly in the angio room. “The typical length of our procedures with XperGuide is usually 15 to 20 minutes. With CT, we usually have to reserve an hour for the same procedure.” Using the CT requires a great deal more radiation exposure as well. “In a straightforward XperGuide procedure, I take one rotational scan for planning and one for a post-procedural check. In a typical CT procedure, I do 5-7 runs of 4 slices every time and I don’t get the same real time information or accuracy.”

Super Adrenal Gland Biopsy

Patient: Female, 50 years-old
Indication: Suspicion of metastasis in super Adrenal Gland
Procedure: “In this procedure, I was working in an area that is highly affected by the patient’s breathing. I waited for the pause between breaths and inserted my needle a little more during each phase. The real challenge here is to avoid the ribs, the intercostal arteries and not puncture the lungs.”
Result: “We used to perform this type of biopsy in the CT room. Now, the biopsy was successfully performed using XperGuide in the angio room in about 15 minutes. The images from XperGuide helped me negotiate a very critical path between breathholds.”



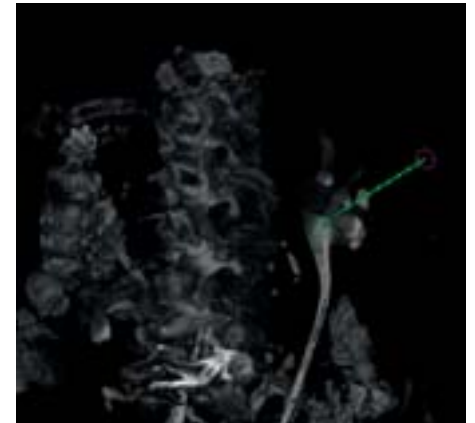
Puncture planning of a nephrostomy in a longitudinal view



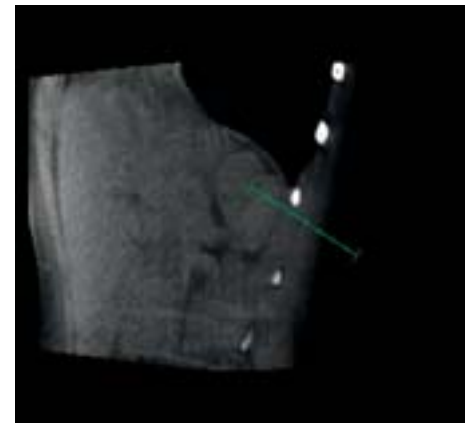
Needle control according to planning path

Nephrostomy drainage

Patient: Male, 73 years-old
Indication: Obstruction of the urinary tract
Procedure: Drainage. “The challenge in this sort of procedure is to place the drain without harming any of the surrounding tissue in an area that is constantly moving.”
Result: “We would usually perform this procedure in the ultrasound room. Thanks to the real-time feedback from XperGuide, we placed the drain in record time, within 10 minutes. We used less radiation and it was less stressful for the patient.”



XperGuide planning of a drainage



Transversal view of the needle path for kidney biopsy

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