Implementing Ultra-low Dose CT with Veo at University Hospital, Brussels

Considerations for workflow and patient selection

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University Hospital, Brussels has been using Veo since March 2011. In addition to ultra-low dose CT imaging—in some instances as low as plain film radiography—Veo provides new possibilities for the radiologist to tailor the scan parameters to the patient. For example, radiologists for years have known that when looking for a pulmonary embolism, the exam is tailored to the indication by administering a faster rate of contrast and scanning the bolus earlier. If the clinician is investigating the possibility of interstitial disease in the lungs, then the radiologist would perform the CT scan at a higher resolution and thinner slices.

These examples, while part of the typical radiology practice, demonstrate the versatility of CT imaging that we have fine-tuned over the course of 20 years. With Veo in our facility, we have further expanded CT imaging into clinical possibilities. We have achieved reduced mA and kV in the acquisition of diagnostic images and thereby been able to reduce dose to previously unthinkable levels.**

Enabled with Veo, these new possibilities can be further tailored to the patient by adjusting CT parameters radiologists have used for decades. In fact, Veo has opened up new possibilities for challenging cases and sensitive patients. For example, while Veo may allow scans at an ultra-low dose, we can still scan at typical dose levels and obtain images with higher spatial resolution and better delineation of structures.

The key to the successful implementation of these new scanning possibilities is determining the appropriate patient group that will benefit most from the Veo technology and understanding how it can be used without impacting radiology workflow.

** In clinical practice, the use of Veo 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 particular clinical task.

Workflow

Veo is a processing technique that generally requires more time (estimated from 20 to 80 minutes) to generate a high-quality image from an ultra-low dose acquisition. In our facility, this has not presented any issues to our radiology workflow. As in most
public hospitals across Europe and the US, radiologists perform their interpretations and reporting in a reading room or back office, well after the exam has been completed, and not in the CT room or while the patient is in the scanner.

In our facility, the need for an immediate diagnosis occurs in approximately 5% of our patients—i.e., emergency cases—and, therefore, we use ASiR for low-dose CT studies in these instances. However, even in emergency cases the physician must often wait 30 minutes for laboratory results, so we believe the additional time to utilize Veo is not an issue considering other test results will require time for analysis.

For the technologist, workflow efficiency is also not compromised. Even with an ultra-low dose scan, the CT scanner immediately provides images so the technologists can evaluate that the proper patient positioning was attained for displaying the anatomy or pathology in question. Our technologist can determine from the initial images that the exam acquired the desired anatomy.

**Patient selection**

A critical component to maintaining an efficient workflow using Veo is identifying patients who would benefit most from an ultra-low dose exam. Because we only have one Veo (box) at our facility, we cannot utilize it on each patient receiving a CT scan. As mentioned above, emergency cases should be evaluated based on other dose lowering techniques available (e.g., ASiR). Radiotherapy patients are also often excluded as the amount of radiation dose from CT is small compared to the treatment they received.

Although we continue to adapt the patient criteria for Veo reconstructions, our facility has identified the following patient groups, who may benefit most from a Veo scan: pediatric patients, particularly those who require regular scanning and follow-up due to a disease or affliction, young adults, adults with a disease requiring regular X-ray or CT imaging follow-up, and adults with kidney disease.

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**Figure 1.** A two-year-old patient with empyema. Exam conducted at DLP 27 mGy.cm with an effective dose of 0.9 mSv (Obtained by EUR-16262 EN, using a pediatric chest factor of 0.031*DLP). Acquisition parameters are 80 kV and 15 mAs.
Historically in our facility, pediatric patients with cystic fibrosis and no health complaints received a lung X-ray every two years. This was the first pediatric group for which we utilized the Veo reconstruction. In most cases, the patients are stable, and some have previously identified lung lesions. We initiated a double-blind study, substituting the X-ray with low-dose CT performed at the same dose level as the X-ray. We noticed we could see more anatomy with the volume CT than the prior X-ray. There were cases where the CT demonstrated an evolution in pathology that was previously deemed stable based on the X-ray data. CT provided the ability to detect lesions more clearly, which in many instances will impact patient treatment. We ultimately moved all cystic fibrosis pediatric patients to Veo low-dose CT follow-up.

Young adults are another category where the benefit from ultra-low dose CT is great. As with pediatrics, the patient’s history and indications are reviewed to determine the best imaging option and appropriate low-dose reduction.

Another group of patients who receive low-dose Veo CT scans at University Hospital are those suffering from Crohn’s Disease. These patients often have complaints related to this bowel disease and receive CT exams.

Lastly, for patients with kidney disease we have adjusted our protocols to lower kVs to help us address iodine use in patients who may be sensitive to it.

Based on our experience, developing the proper Veo protocols—both in patient selection and implementing low-dose imaging—is important for successful implementation. As one of the first sites to clinically use Veo, we continue to examine Veo’s potential and implementation on specific patient groups.

One thing we learned is that we cannot uniformly lower dose for every indication when changing the protocols. For each patient group, we are still building our experience and determining the appropriate dose levels. Additional scientific studies, including the global multi-site clinical study that GE is sponsoring, will provide additional information to help optimize dose level protocols for each patient group.

Editor’s note: For more information on the global multi-site clinical study, please see article on page 54.

Welcome to the era of Low-Dose By Design. Our new low-dose adult clinical protocols offer a safer imaging experience with fewer artifacts and greater visibility. With an assumed dose level of 10 mSv, these protocols provide a four-fold reduction in dose when compared to our previous adult protocols.

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Located in the heart of Europe, the University Hospital Brussels is one of Belgium’s premier centers of excellence in healthcare, biomedical research and medical education. One of seven University Hospitals in Belgium, it is closely associated with the Brussels University. University Hospital Brussels has gained recognition at both a national and an international level. With its 700 beds and staff of 3,000, close to 30,000 inpatients and 500,000 outpatients are treated every year.