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Revolution HD Upgrade Delivers Advanced Dose and Metal Artifact Reduction Technologies

In Northern Germany near the Denmark border, the 600-bed hospital, DIAKO Krankenhaus Flensburg (Deaconess Hospital Flensburg), provides care to more than 80,000 inpatients and outpatients each year. As a large academic institution, the hospital's radiology department strives to have the latest and most advanced technology available.

Stefan Müller-Hülsbeck, MD, PhD, Chief Physician, Institute of Diagnostic and Interventional Radiology and Neuroradiology, is accustomed to having a large patient workload in his department, particularly in CT imaging. Although he was pleased with the performance of Discovery™ CT750 HD, he learned the system could be upgraded to Revolution™ HD featuring GE's

groundbreaking iterative reconstruction technology, ASiR-V™, and Smart MAR for visualizing anatomy in the presence of metal, all at a fraction of the cost of installing a new system.

"To acquire the latest generation technology, such as ASiR-V, with high image quality and fast reconstruction times all within our budget is a clear advantage for our department," Professor Müller-Hülsbeck says. "It is of the utmost importance for our patients to receive lower radiation dose from medical imaging in their lifetime, especially younger men and women."

In addition to gaining the capabilities of ASiR-V, DIAKO Krankenhaus Flensburg also obtained Smart MAR

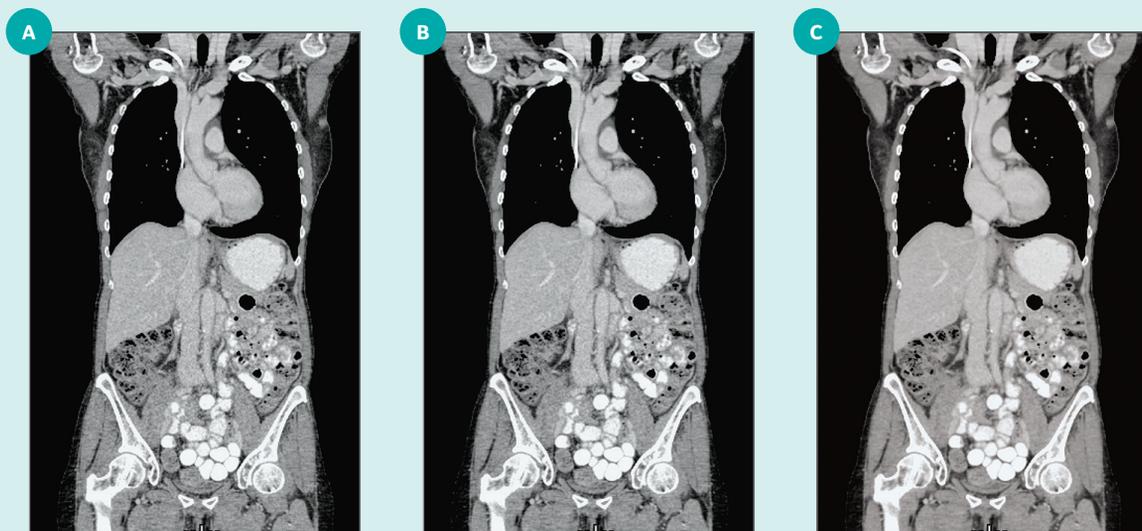


Figure 1. Abdominal CT study processed with (A) filter-back projection (FBP), (B) ASiR 50% and (C) ASiR-V 80%.



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(Smart Metal Artifact Reduction), an innovative, projection-based method that significantly reduces metal artifact through a three-step algorithm. This innovative, projection-based method helps to reduce photon starvation, beam hardening and streak artifacts caused by metal in the body, such as hip implants, spine screws and dental fillings.

In March 2017, the upgrade was completed after just one day. The entire process was well organized and ran smoothly, Professor Müller-Hülsbeck adds, and there were no glitches in the operation of Revolution HD's hardware and software from day one.

Smart MAR

As more surgical procedures involve implants and splinting, it became increasingly important for DIAKO Krankenhaus Flensburg to have a robust metal artifact suppression technique.

"With Smart MAR, we have received an additional tool that further improves the artifact reduction and makes the diagnosis in this difficult patient group more appropriate, accurate and, for the referring clinicians and us, more confident in the results," Professor Müller-Hülsbeck explains. "This is important for multiple specialties."

For example, after the placement of an endovascular coil, CT is used immediately after the procedure to verify there are no signs from early infarction or bleeding resulting from endovascular treatment by comparing these images to ones acquired prior to the procedure. These coils typically cause significant metal artifacts, Professor Müller-Hülsbeck explains, which obscures the pathology adjacent to it.

"It is very helpful to have a scanner with Smart MAR to reduce the metal artifact and have better visibility in the area of interest to ensure there are no complications," he adds.

Now with Smart MAR, the hospital can use a scan protocol with a fully integrated metal artifact reduction technique that provides the highest image quality and no disadvantages for work in daily routine. Perhaps most important, Professor Müller-Hülsbeck says that Smart MAR can also be applied retrospectively.

"This is of the utmost importance, as sometimes we image patients and they are either not aware of the implant being metal, they don't understand the importance of providing that information to us or they simply forgot to mention it," he says. Since the system is located in a

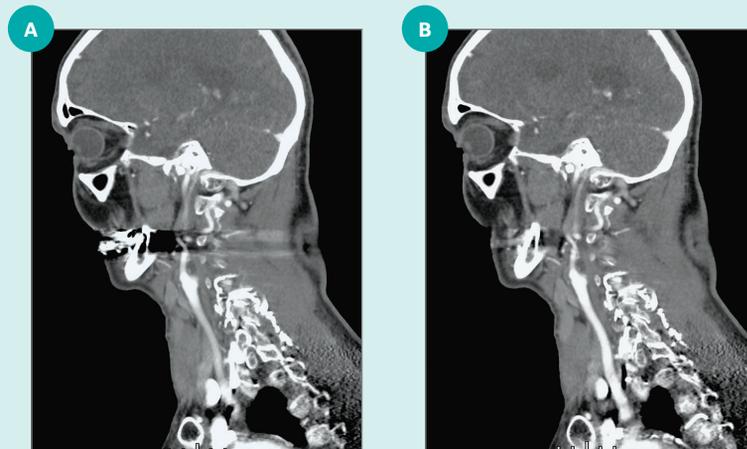


Figure 2. (A) Head/neck image acquired without Smart MAR, note the metal artifact from dental fillings. (B) Same image acquired with Smart MAR.

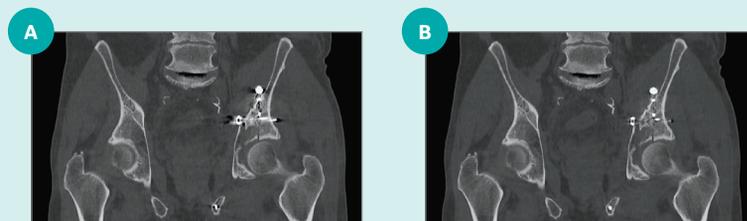


Figure 3. (A) Pelvic image acquired without Smart MAR, note the metal artifact from implanted hardware. (B) Same image acquired with Smart MAR.



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hospital, it is very common to scan patients after trauma surgery or receiving an implant, such as joint replacement, valves or pacemakers. “To apply this retrospectively in virtually any scan is a major advantage for us.”

He already credits Smart MAR with a reduction of non-diagnostic studies. Sometimes, there is no alternative imaging exam other than CT for patients with metal implants, he explains, and this capability is leading to more diagnostic-quality CT exams.

Lowering dose

ASiR-V is utilized in as many CT imaging exams as possible at DIAKO Krankenhaus Flensburg. Fully integrated into the department workflow, ASiR-V is now enabling 20-30% dose reduction, especially in neck, lung and abdomen exams, in addition to the 40-50% dose reduction achieved when the hospital switched from filtered back projection (FBP) to ASiR.

“From my experience, ASiR-V provides us with accurate imaging and a major improvement in dose reduction,” adds Professor Müller-Hülsbeck. “What we have today with ASiR-V is very promising for the future of dose reduction.”

With a continued increase in large-sized (obese) and high body-mass index patients, there is only so far the clinician can drop the dose and still have a diagnostic exam.

Professor Müller-Hülsbeck says that ASiR-V helps combat this issue by reducing the noise level and improving low-contrast detectability for all patients—but especially in pediatric, young-to-middle aged adults and those requiring frequent exams.

Revolution HD provides additional dose management tools, such as a warning if the scheduled scan or estimated dose falls out of the allowable reference levels set by the institution. There is an organ dose modulation tool for the eyes, thyroid and breast that also reduces dose to these organs, which further aligns with providing the best imaging possible at the lowest possible dose.

Complementary technologies

As importantly, Professor Müller-Hülsbeck has discovered advantages to using ASiR-V along with Smart MAR. By using these together, he can visualize anatomic details obscured by metal artifacts for a higher confidence in the diagnosis, as well as deliver up to 80% less dose to the patient compared to using FBP.

CT is often used for emergency and trauma patients who may have implanted metal and can likely receive more than one CT during their hospital stay. With the trauma protocol, the hospital can utilize ASiR-V to lower the dose and then apply Smart MAR retrospectively if the patient had an implant. It’s a double win for the patient and the radiologist.

Also benefiting the patient and diagnosis is the improved reconstruction speed on the CT console. “We have significantly faster access to the reconstructed images and that is good for the patient,” Professor Müller-Hülsbeck says.

“We know that with CT and PET, patient radiation dose from medical imaging has likely doubled in the last decade,” Professor Müller-Hülsbeck adds. “With ASiR-V we have a tool that can help us reverse this trend, and with Smart MAR we can reduce the number of non-diagnostic exams due to metal implants that could lead to a repeat study.” ■

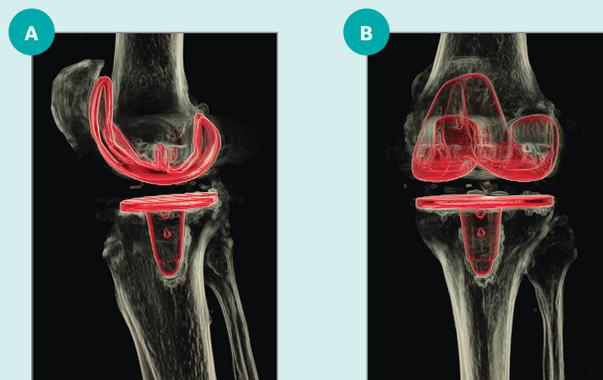


Figure 4. (A, B) Knee images acquired with Smart MAR.