



Revolution CT a Crucial Component for Developing New Clinical Protocols in the ER

A recent study found that emergency room (ER) physicians' diagnosis, diagnostic confidence, and patient management are likely to change after a patient receives a CT study. The authors reported the leading diagnosis changed in 51% of patients with abdominal pain, 42% of patients with chest pain and/or dyspnea, and 24% of patients with headache.¹ While there has been some discussion on overutilization of CT in the ER, this same study indicates that ER departments should focus on improving current referral practices in cases where CT may positively impact patient care.

Jena University Hospital

At Jena University Hospital in Thuringia, Germany, Professor Ulf Teichgräber, MD, MBA, Institute Director at the Institute for Interventional and Diagnostic Radiology (IDIR), has worked with his colleagues to develop clinical algorithms for determining the appropriate use of CT across a multitude of patient conditions. The most common cases where CT is employed in Jena's ER/trauma unit are trauma, chest pain, and stroke. Chest pain, caused by cardiac, aortic, and pulmonary disease, represents 12% and suspicion of stroke represents 3% of the yearly ER/trauma visits.

These ER CT studies are critically important, helping ER clinicians address these complex patient cases quickly and confidently. Recognizing this, Jena has a Revolution™ CT located right in the center of the trauma bay, ready to provide clinicians with the information they need to treat patients and save lives.

"We established in our ER department certain algorithms for how we use the scanner," Professor Teichgräber says. In a department that sees an average of 33,000 patients each year, proper CT utilization is a key factor. "We want the right patient in the CT scanner."

In Jena's ER, patients are triaged into hemodynamically stable and unstable. Unstable patients with an ECG predictive for acute coronary syndrome (ACS) are directly sent to the cath lab. Patients without suspicion for ACS undergo fast ultrasound on the CT table and then Triple

Rule Out CT. Patients that are hemodynamically stable are further triaged by biomarkers and clinical risk scores and undergo dedicated CT for coronary artery, aorta, and pulmonary artery assessment.

"Stroke patients often have underlying heart conditions," Professor Teichgräber explains. "So we established a new protocol to combine stroke and chest pain management. To do it we need the right technology; for us, Revolution CT provides the technical capabilities to perform this new protocol."

The new protocol is called the Big Five. "It's a combination of the ECG gated heart CTA, combined angiography of the thoracic aorta and cerebral arteries, and CT brain perfusion," says Lucas Lehmkuhl, MD, PhD, Modality Manager for CT at Jena University Hospital.

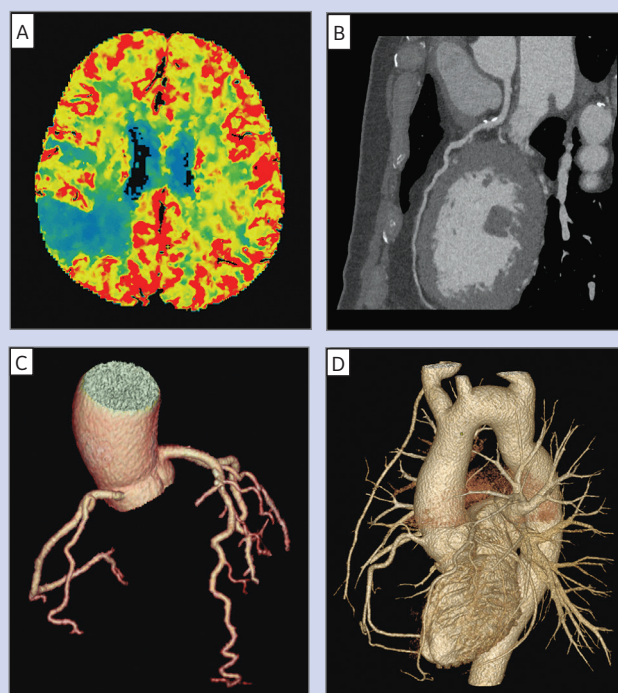


Figure 1. Jena University Hospital has developed the Big Five protocol, which includes ECG gated heart CTA, combined angiography of the thoracic aorta and cerebral arteries, and CT brain perfusion. (A) Brain perfusion for stroke; (B, C) ECG gated heart CTA demonstrating calcified plaque; (D) combined angiography of the aorta and pulmonary artery.

Images courtesy of Jena University Hospital, Thuringia, Germany.



“The CT is really at the heart of the ED.”

Professor Reto Meuli, CHUV

According to Professor Teichgräber, Revolution CT is critical to the implementation of the Big Five protocol. “The new Revolution CT, with the large detector and high rotation speed, enables us to perform an angiography protocol from the chest up to the brain in one exam lasting a few seconds. This is completely new to combine these two protocols into one—historically we usually look at either the chest or brain but not both.”

In addition to triaging chest pain patients and those with suspicion of stroke, the CT is also used for about 170 severe polytrauma cases per year. “Our trauma management happens right on the CT table,” he adds.

A new option on Revolution CT that also plays an important role in ER imaging is ASiR-V™, GE’s new blended IR algorithm. With younger patients, ER clinicians were previously more inclined to wait for lab reports before CT, Professor Teichgräber explains. However, with Revolution CT, the patient radiation dose is 50% less* than with prior CT technology, so ASiR-V is used on all patients and in all protocols at Jena University Hospital. In pediatric patients, it is possible to go with even lower doses, he adds.²

“We know that using CT in the ER has a clinical impact in decision making,” explains Dr. Lehmkuhl. “With an immediate

diagnosis, we have a clear decision for patient care and also for discharge. With Revolution CT, there is the ability to image higher heart rates and still have sharp images of the aorta.”

“The best way to prevent overutilization of CT in the ER is to clearly establish clinical CT protocols dedicated to the underlying disease and based on established guidelines for every major condition that presents to the ER. Then, the clinician can decide if CT is appropriate or not,” Professor Teichgräber says.

Lausanne University Hospital (CHUV)

As one of five university hospitals in Switzerland, Lausanne University Hospital, also known as Centre Hospitalier Universitaire Vaudois or CHUV in this French-speaking area of Switzerland, handles 39,000 emergency patients/cases each year, with 14,000 patients brought in by ambulance. Altogether, 15,200 CT exams were performed on the Revolution CT located in the ER; 6,000 of these exams were for ICU or other inpatients.

A Revolution CT is situated 20 meters (60 feet) from where patients are brought via ambulance and 100 meters (300 feet) from the ambulatory ER entrance. A critical care unit

* In clinical practice, the use of ASiR-V 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.

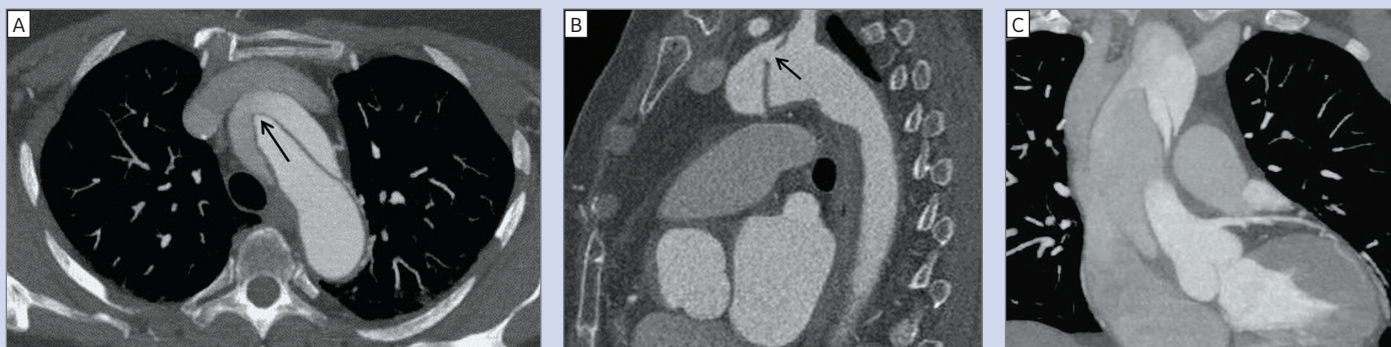


Figure 2. A 58-year-old woman with loss of consciousness and suspicion of cerebral stroke. Head and Neck CTA was ordered where an aortic dissection (type A Stanford) was partially shown on the most caudal images with a very short extension into the brachiocephalic trunk and into the left subclavian artery. Protocol was immediately changed to include CTA of the thoracic aorta with cardiac gating. The additional images demonstrate the intimal flap which is fenestrated already, and the dissection extending from the aortic root until shortly after the bifurcation of the left subclavian artery. Coronaries are normal and there is no cerebral stroke.

Images courtesy of Lausanne University Hospital, Lausanne, Switzerland.

with 40 beds is also near the ER and since 1999, a CT has been installed in CHUV's ER department.

According to Professor Reto Meuli, MD, PhD, Chief of the Department of Medical Radiology at CHUV, the CT runs 24 x 7 with all emergency CT exams performed within two hours. Polytrauma and stroke patients are given top priority, while suspected pulmonary embolism, cardiac disease, and other cases are typically scanned within one hour. The majority of patient cases are minor trauma, including the head.

"CT is the main imaging tool in the ER for many different indications, including PE, aortic dissections, chest pain or any type of trauma," he explains. The only deviation in patients with acute abdominal pain adds Sabine Schmidt, MD, Chief of the ER, are cases of suspected appendicitis and acute cholecystitis where ultrasound is utilized first.

With Revolution CT, CHUV now has the advantage of using ASiR-V. "We have excellent image quality at a lower dose level," says Dr. Schmidt. For certain indications, such as renal stone disease, the dose is actually lower, she adds. In fact, Dr. Schmidt notes that CHUV is among the lowest for dose in cases of polytrauma when compared with other facilities nationally.

Brain perfusion studies can be performed with larger coverage at the same dose using ASiR-V, Professor Meuli says. With the fast rotation speed, it is now easier to time the acquisition to the bolus for thoraco-abdominal angio studies, and the patient breath hold is not as critical.

However, the system speed isn't used to increase throughput at CHUV; it's used to improve the exam quality. "With this system, you can have both an accurate diagnosis and dose optimization, so you need to find the balance between them, especially for pediatrics and young adults," Professor Meuli says.

This is also important when considering whether to use CT for a particular patient case. "Have guidelines and follow them," he adds. "The daily job of radiology is to evaluate the request from the ER for appropriateness—it is difficult to measure overuse but facilities can make an assessment by comparing their department to other centers."

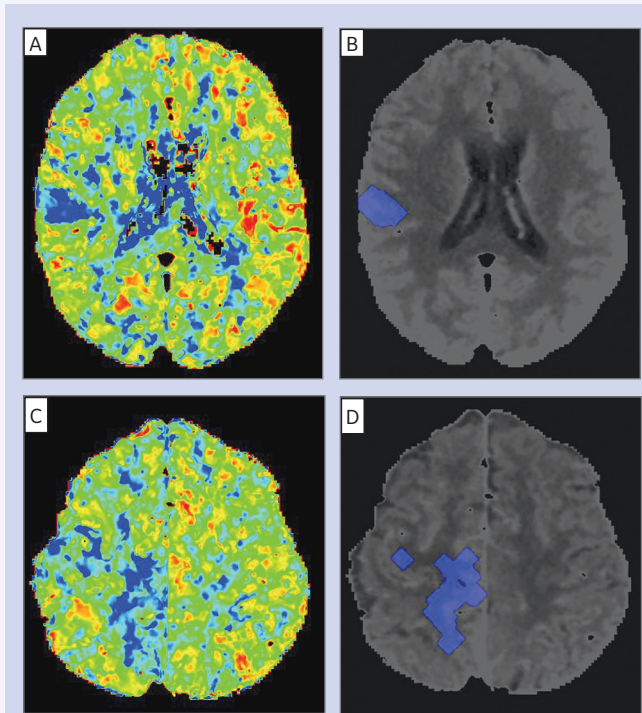


Figure 3. With a large detector, Revolution CT has the capacity to detect multiple small infarct in different brain vascular territories, raising the diagnosis of cardiac thrombotic source (in this case, atrial fibrillation). Note the focal ischemia in the mid-cerebral artery territory on (A) the Tmax perfusion map and (B) tissue classification, as well as a second focal infarct in (C, D) the anterior cerebral artery territory.

Images courtesy of Lausanne University Hospital, Lausanne, Switzerland.

In fact, Professor Meuli and his colleagues performed a retrospective evaluation on pediatric ER visits and found that they were performing relatively few CT exams on this patient population. In cases of mild trauma, clinical judgement rather than medical imaging helped drive patient care pathways. When CT is utilized for any patient, DoseWatch™, a web-based patient radiation dose monitoring software, is used to capture, track, and report radiation dose directly from any imaging device or PACS. DoseWatch is multi-modality and vendor agnostic.

Yet, what's really crucial in the ER is the ability to use a diagnostic tool such as CT to help address difficult clinical situations in critical patients and save lives. Says Professor Meuli, "The CT is really at the heart of the ED." ■

References

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2. Fan J, Yue M, Melnyk R. Benefits of ASiR-V™ Reconstruction for Reducing Patient Radiation Dose and Preserving Diagnostic Quality in CT Exams. GE Healthcare, 2014.