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Siemens Healthineers Presents Imaging for Complex, Minimally Invasive Procedures at ESC 2016



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- Integrated imaging portfolio for the entire cardiology treatment process
 - Acuson SC2000 Prime ultrasound system enables real-time 3D heart imaging for reliable diagnosis of mitral insufficiency
 - Sensitive patient groups benefit from unique dual-source CT scanners for cardiac CT imaging
 - Heart MRI supports the treatment decision by revealing hypoperfusion and viability of the heart muscle

Siemens Healthineers is helping cardiology customers optimize medical imaging at every stage of cardiology treatment as part of a comprehensive workflow. One focus at this year's Congress of the European Society of Cardiology (ESC) is the trend toward more minimally invasive interventions, especially in more complex cases. Medical imaging in diagnostics, therapy and follow-up is essential in the case of minimally invasive interventions. Many heart patients today have already reached an advanced age by the time they are diagnosed with a structural or coronary heart disease, and this crucially influences the potential treatment options. For these sensitive patient groups, for example, open heart surgery is no longer an option given the overall risks of general anesthesia and rehabilitation, and existing chronic diseases like diabetes or heart failure. For these complex cases, lower-impact procedures that can be performed minimally invasively represent an important treatment approach.

Structural heart diseases are triggered often by age-related, anatomical, morphological or functional changes in the heart. Mitral valve dysfunction is one of the most commonly occurring structural heart diseases affecting the elderly. The most common functional disorder of the mitral valve prevents it from closing properly. This causes blood to flow back into the left atrium, a process known as regurgitation, which leads to impairment of

the heart's pump function. To avoid this, the mitral valve must be repaired, or replaced if repair is no longer an option. This is where medical imaging plays a key role in diagnosis, risk assessment, and also choice of treatment.

Precise diagnosis with transesophageal echocardiography (TEE)

TEE enables real-time images of the heart. A transesophageal probe is fed into the patient's esophagus. The probe generates images using high-frequency ultrasound waves. It was for this task that Siemens Healthineers developed the Acuson SC2000 Prime, combining two state-of-the-art technologies: the ultrasound system can produce 3D TEE full-volume color Doppler images of the heart and blood flow, and the integrated eSie Valves analysis software supports precise measurements of the individual heart valves in just seconds. This makes it easier to choose the medical implants available for use. 3D ultrasound images also enable the extent of mitral valve regurgitation and the structure and measurement data of the heart as a whole to be analyzed. Based on this information, an interdisciplinary heart team decides whether surgical or minimally invasive intervention is the most appropriate treatment approach.

Previous 3D TEE methods required stitching, the fusion of multiple heartbeats, to form a complete image of heart function and blood flow. This approach could potentially lead to misleading results, especially in patients with cardiac arrhythmias. Now, with the TEE ultrasound probe in the Acuson SC2000 Prime, 3D images of the heart can be recorded in real time with no need for stitching. "It really makes a difference when you can see complete anatomy and blood flow at high volume rates with Siemens real-time 3D TEE. It enables you to perform valve procedures with more accuracy and more confidence, potentially improving patient safety and outcomes. It is truly a step forward in technology," says cardiology Professor Stéphane Lafitte, Hôpital Cardiologique CHU in Bordeaux, France.

Complex coronary heart diseases such as chronic total occlusions (CTO) also necessitate imaging-supported diagnosis to facilitate the choice between the surgical option of a bypass operation and a minimally invasive percutaneous coronary intervention (PCI). Computed tomography can be used ahead of the intervention to evaluate the affected segments of the coronary vessels.

Treatment planning for vessel occlusions via cardiac CT and MRI

The unique dual-source CT scanners from Siemens Healthineers make it possible to perform CT imaging with particularly low doses of radiation and contrast medium. The high rotational speed of the Somatom Force and the resulting temporal resolution of only 66 milliseconds for a complete cardiac dataset make it unnecessary for patients to hold their breath or to take medications like beta blockers to regulate their heartbeat. The dual-source CTs from Siemens Healthineers also greatly reduce the volume of iodine contrast media that has to be injected, since that can prove an additional burden on the kidneys in older patients with renal failure in particular. The software syngo.CT Coronary Analysis can rule out coronary heart disease in less than a minute after the scan or, if there is narrowing of the arteries, this can be quantified and characterized. In this way, precise diagnostics can help avoid unnecessary intervention or, if intervention is needed, it can be planned precisely in advance.

Visualization of the heart using an MRI, to evaluate circulation in the heart muscle or the relevance of a stenosis, can also provide valuable information for further treatment. The Cardio Dot Engine software automatically locates the axes of the heart to ensure a swift, uncomplicated workflow. This simplifies the

examinations and supports reproducible results. The MyoMaps MRI application can help identify an accumulation of tissue fluid in the heart muscle, a possible consequence of the stenosis, and represent it in color. This is particularly helpful in the case of heart diseases that involve minimal tissue lesions that are distributed across the entire heart. Heart muscle tissue at risk from hypoperfusion can be identified using an MR perfusion examination and the syngo.MR Perfusion evaluation software. The information gathered from the heart MRI provides the basis for decision on further treatment.

Imaging in the catheterization laboratory for direct control during treatment Minimally invasive therapy is used for both mitral valve replacement and to treat coronary stenoses in the cardiac catheterization laboratory. The increasing complexity of the interventions necessitates precise visualization of the anatomy and the implanted mitral valves or coronary stents, which places particular demands on the imaging systems.

The benefit of real-time 3D ultrasound imaging provided by the Acuson SC2000 Prime comes into play with minimally invasive mitral valve therapy, since its fullvolume color Doppler function enables the placement of the implant to be checked immediately, while the patient is still on the operating table. For coronary artery treatment, software applications like Clearstent and Clearstent Live, which are available for all Artis C-arm systems from Siemens Healthineers, help visualize the stents both during and after implementation. Imaging can provide static images or, with Clearstent Live, real-time images that also make it possible to observe the opening of the stent and check how it is placed. This uses a software algorithm that aims to compensate for heart movements virtually by aligning the X-ray images using the visible stent markers. "Clearstent allows us to see stents that are poorly expanded, stent fractures, and other situations that we might not even be able to identify without stent enhancement, but which are important for making clinical decisions," says Prof. Stephan Achenbach, Chairman of Cardiology at Erlangen University Hospital, Germany, describing his experiences with Clearstent.

Other imaging modalities can be used both for mitral valve procedures and for coronary interventions, depending on the progress of treatment. This also applies to follow-up, which is meant to ensure a lasting, positive result for the patient. For example, using the syngo.CT Coronary Analysis software if a patient develops further chest pain can rapidly help diagnose further narrowing of the arteries.

Siemens Healthineers adopts an innovative approach to make the best use of the wealth of opportunities available in the area of intraoperative imaging. For example, images from pre-procedural CT and MRI examinations can be overlaid on the images generated in the cardiac catheterization laboratory. That supports the intervention process by providing additional clinical information from the CT or MRI images, making it possible to reduce the dose accordingly.

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