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Pressemitteilung

Universitätsklinik der Ruhr-Universität Bochum - Herz- und Diabeteszentrum NRW Bad Oeynhausen
Anna Reiss

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Premiere in Europe: Holography in Cardiac Medicine

Herz- und Diabeteszentrum NRW, Bad Oeynhausen: "Three-dimensional imaging quality facilitates new ways of evaluating and treating structural cardiac diseases." Experts have been discussing the use of holograms to support medical-clinical decision-making and treatment for more than two decades. The technology is now so far advanced that physicians can simultaneously take an exact replica of the beating heart of a patient and turn it around in their hands, look at it from all angles or measure distances with their fingertips. For the first time ever in Europe, this has now become reality at the Herz- und Diabeteszentrum NRW (HDZ NRW), Bad Oeynhausen.

What sounds like science fiction could very soon revolutionize catheter interventions for the treatment of structural cardiac diseases.

What is the potential of this innovative technology?

Professor Dr. Volker Rudolph, Director of the Clinic for General and Interventional Cardiology at the HDZ NRW (Ruhr-University of Bochum), recently presented insights into the future of AI-based cardiac catheter interventions at the Herz-Kreislauf-Tage congress in Dresden – where he raised considerable interest in his specialist audience with a video clip recently recorded at the HDZ.

The film shows his interventional cardiology team at work in their cardiac catheter laboratory. CT images of the heart created using artificial intelligence are now standard procedure during minimally invasive structural heart interventions, and they will continue to help further improve the planning of catheter interventions.

Hologram: all eyes on a floating heart

Altogether different is the first ever holography system in Europe, which can now be used in Bad Oeynhausen alongside the CT images. For the first time, physicians are able to experience in real time, the heart of the patient with all its anatomical anomalies, as a three-dimensional hologram floating in front of them, , within hands reach. They can not only observe it from all angles with more precision and much more effectively than before; they can also turn the hologram of the patient's heart around using their fingertips, enlarge it, crop it, measure it or zoom in on parts of it in more detail.

Not an optical illusion, but an optical reality

"Our initial skepticism quickly turned to fascination as the possibilities of this intuitive and interactive technology became clear", Prof. Rudolph reports. "It is not an optical illusion, but a high-resolution, dynamic 3D projection in the air, generated live from our volumetric patient data. The additional evaluation options provided by the cardiac hologram will help to avoid errors of perspective, especially in highly complex cases."

Senior Physician Dr. Kai Peter Friedrichs adds: "Imagine a very difficult intervention in a heart valve which is difficult even for experienced specialists to evaluate due to very rare or complicated anatomical structures, or a pre-existing implant. Until now, the patient-specific anatomy was imaged in two dimensions on a monitor. Using holography, we can observe and treat all peculiarities of the heart in multiple dimensions, live and in real time. We particularly value this option when guiding the catheter is tricky due to the anatomic situation and we need to position a new heart valve or correctly place a valve ring during valve reconstruction."

The Bad Oeynhausen catheter specialists all agree that this technology is so convincing and the quality of the images so impressive that it is worth pursuing the possibilities of holography in clinical applications. "It could contribute to making routine interventions even safer and faster. And of course we hope, especially in our specialist field of complex structural cardiac diseases, to further improve treatment results."

The holograms are generated during the intervention from ultrasound data acquired from the heart valves and chambers through the esophagus. This so-called transesophageal echocardiography (TEE) facilitates the precise imaging and localization of heart valve defects, the smallest of blood clots and any potential deposits.

To date, this innovative holography technology for cardiac medicine (HOLOSCOPE-i™, RealView Imaging Ltd., Israel) is only available in Europe at the HDZ NRW in Bad Oeynhausen. In the Clinic for General and Interventional Cardiology/Angiology, the next step is to gain more practical experience with hologram evaluations in the cardiac catheter laboratory. In parallel, Clinic Director Prof. Dr. Volker Rudolph and Senior Physician Dr. Kai Peter Friedrichs will be paying special attention to the training of young medics in the use of holography, as well as the highly precise treatment of complex structural cardiac interventions. The HDZ NRW will also be scientifically comparing its holographic visualization of medical images with international publications from the USA and Israel.

Background information:

A hologram is a three-dimensional image which appears as the result of interference of light rays from a laser or other coherent source of light. Holography was discovered in London in 1948 by the Hungarian physicist Dennis Gabor, who was awarded the Nobel prize for Physics in 1971 for his fundamental work on electromagnetic waves and "invention and development of the holographic method". Until today, holography remains the best way of precisely reconstructing and visualizing 3D objects in the air. Since a hologram is an optical reality, it is almost impossible to distinguish between a high-quality reconstructed hologram and the original real object.

A structural heart disease is said to exist when the heart valves or walls of the heart show structural changes which restrict cardiac function. These changes are usually acquired over time, but can also – more rarely – be congenital. Of the acquired heart valve diseases, aortic valve stenosis (a constricting of the aortic valve) and mitral or tricuspid valve insufficiency (leaking of the mitral or tricuspid valve) are two of the most common. In severe cases the mortality rate is high if left untreated, and such patients should therefore, when possible, undergo surgery or intervention.

At the HDZ NRW Heart Valve Center in Bad Oeynhausen, cardiac specialists from the fields of cardiology, cardiac surgery and anesthesia work closely together. Every year, more than 2,100 interventions are performed to treat structural heart diseases (>1,100 aortic, >500 mitral and about 200 tricuspid valve interventions, as well as 250 combined interventions. In addition, there are almost 100 procedures for congenital heart valve diseases that are carried out in the Center for Congenital Heart Defects. Basically a detailed diagnostics and a case discussion takes place in an interdisciplinary conference, with the aim of finding the best possible treatment for each individual patient.

As a hospital specialized in the treatment of cardiac, vascular and diabetic diseases, the Herz- und Diabeteszentrum Nordrhein-Westfalen (HDZ NRW), Bad Oeynhausen, is one of the largest and best equipped centers of its kind in Europe, treating 36,000 patients per year, 14,500 as inpatients.

The Clinic for General and Interventional Cardiology/Angiology (Director: Prof. Dr. med. Volker Rudolph) at the HDZ NRW is specialized in the treatment of coronary artery disease, heart valve defects, myocardial diseases and inflammatory heart diseases. More than 5,000 catheter-based procedures are performed in the Clinic every year. State-of-the-art diagnostic and imaging techniques, as well as all the latest catheter procedures ensure the best possible and most gentle medical care of patients. The Clinic is a European and National Center of Excellence for the treatment of hypertension, an accredited Chest Pain Unit (CPU), as well as a certified National Center for the care of adults with congenital heart defects (ACHD).

Further information:

Herz- und Diabeteszentrum Nordrhein-Westfalen
University Hospital Ruhr-University Bochum
Press Office and PR
Head: Anna Reiss
Georgstr. 11
D-32545 Bad Oeynhausen
Tel. 0049 5731 97-1955
Fax 0049 5731 97-2028
E-Mail: info@hdz-nrw.de

wissenschaftliche Ansprechpartner:

Prof. Dr. Volker Rudolph
Director of the Clinic for General and Interventional Cardiology
Herz- und Diabeteszentrum NRW, Bad Oeynhausen
Germany

URL zur Pressemitteilung: https://youtu.be/NOYgdivucYs

URL zur Pressemitteilung: http://www.hdz-nrw.de

Anhang Pressemitteilung HDZ NRW March 14, 2024 http://idw-online.de/de/attachment102458

European premiere: This montage shows Senior Physician Dr. Kai Peter Friedrichs working with holographic medical technology at the HDZ NRW. Clinic Director Prof. Dr. Volker Rudolph (top left) and his team all follow the intervention (photo/montage:HDZ NRW/DukkArt)
HDZ NRW