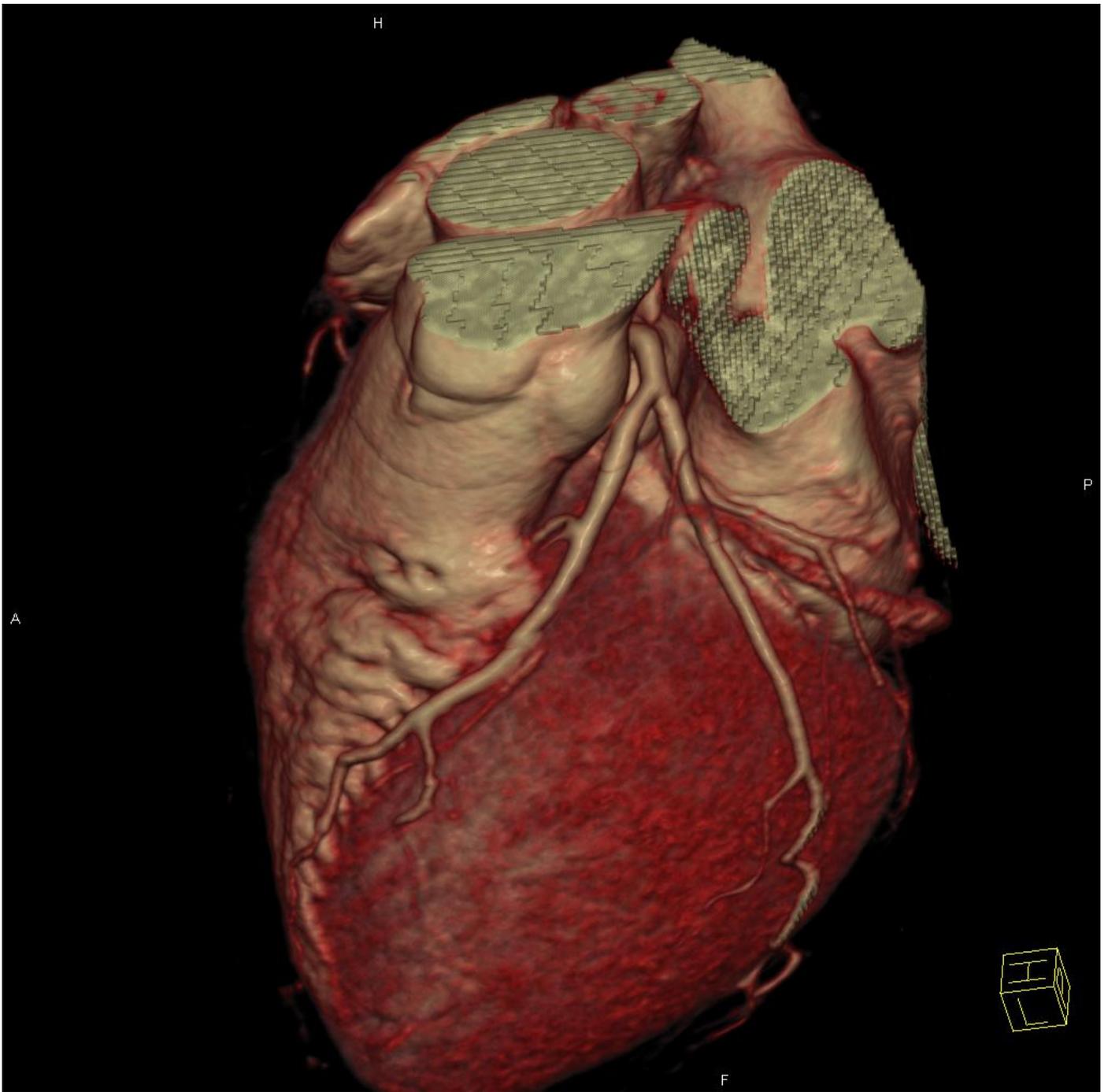


Heart catheter examinations - an elegant method with huge potential

The method is elegant and cardiologists love it – heart catheter examination. The number of catheter examinations carried out has continuously increased over the last few years. In 2005 in Germany, an impressive number of 772,000 heart catheter examinations were carried out. The method is equally part of everyday clinical life at the Heart Centre in Bad Krozingen. In order to find the cause of heart problems, the Bad Krozingen hospital carries out 7,000 heart catheter examinations every year. In 2,700 to 3,000 cases, the technology is used either to remove dangerous constrictions in the blood vessels or in emergencies, such as in the treatment of cardiac infarctions.

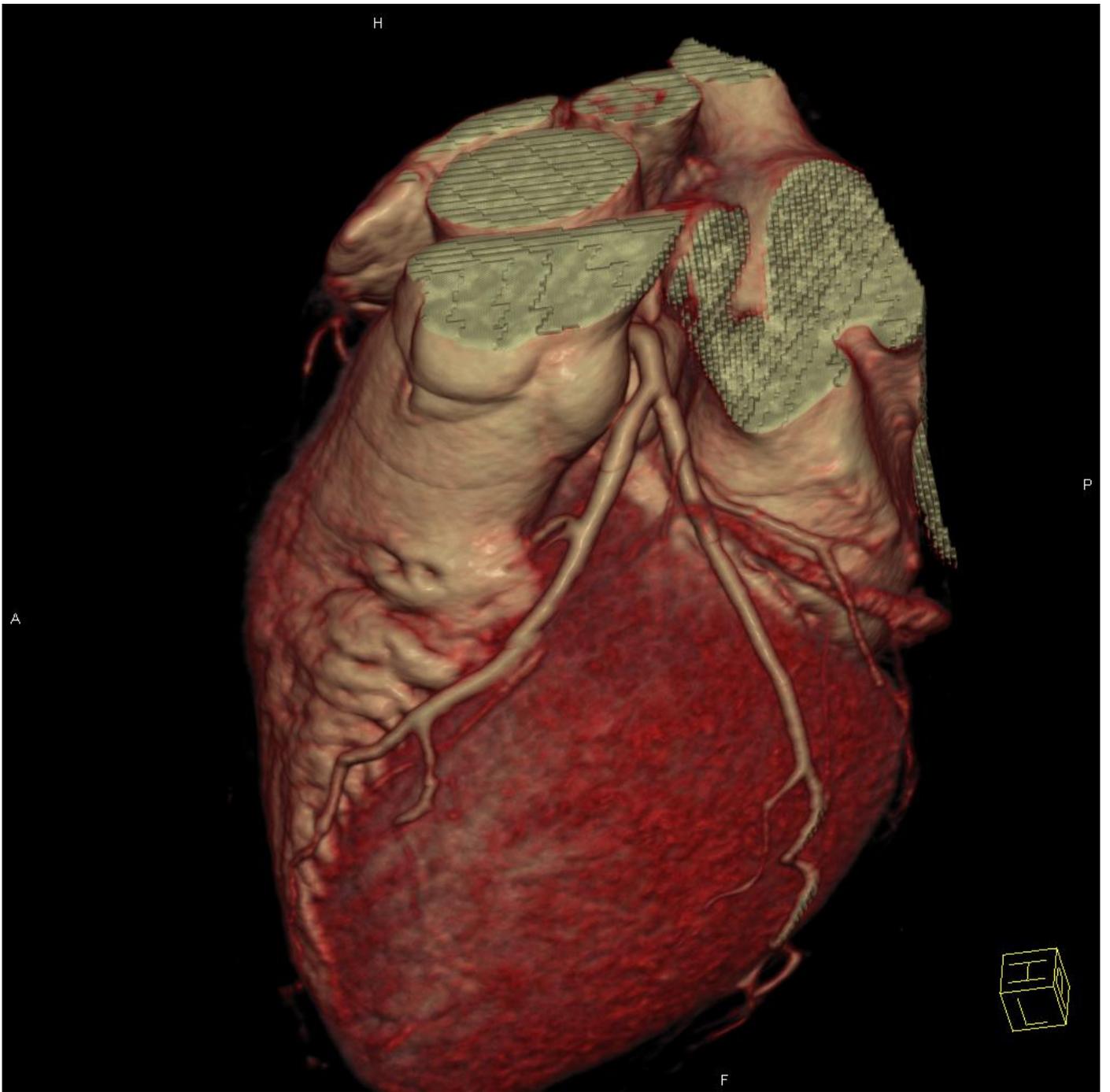
In many cases, patients undergoing heart catheter examinations suffer from angina pectoris. This means that the vessels which supply the heart with blood – the coronary vessels – are constricted in at least one place to a degree that prevents the supply of the heart with sufficient amounts of oxygen. Under physical stress, the patients report diffuse chest pain, pain below the chest bone or in the left arm. When resting, the patients concerned do not usually experience any pain. If stress ECGs are carried out on these patients, doctors normally discover changes that suggest blood circulation disorders. The patients then undergo examination in a heart catheter laboratory in order to confirm the diagnosis.



Heart and coronary heart vessels displayed via multilayer computer tomography
© Heart Centre Bad Krozingen



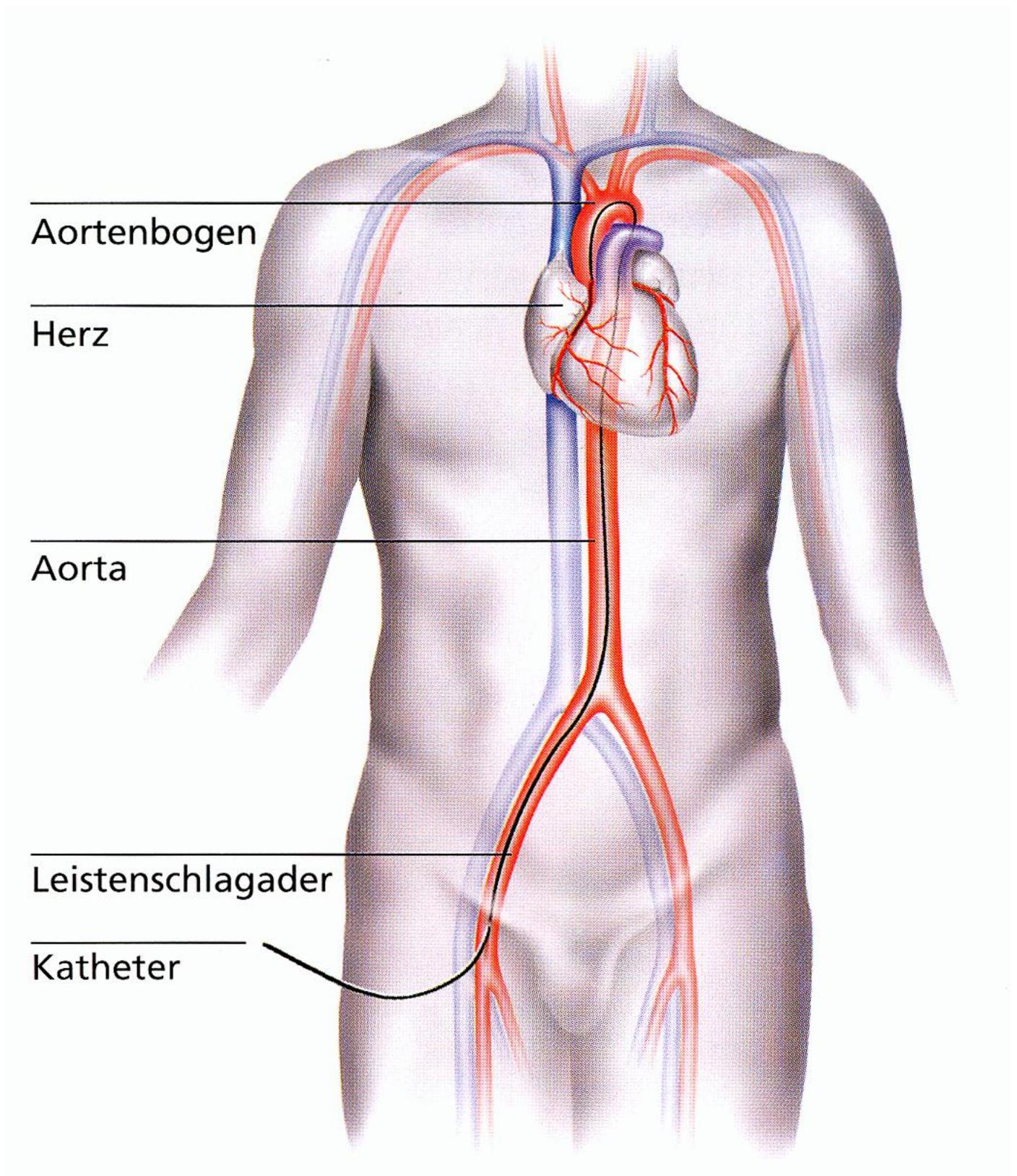
A 3D model of the heart and the coronary heart vessels from another point of view.
© Heart Centre Bad Krozingen





Small constrictions do not normally affect the blood flow

Local anaesthesia, a prick in the groin or hand joint artery, and the cardiologist is ready to insert a heart catheter – a thin tube – through the blood vessels up to the coronary heart vessels. A contrast agent is then injected into the vessel. Medical specialists call this type of examination coronary angiography. The examination visualizes the arteries in X-ray images and enables the doctor to identify dangerous constrictions or even obstructions. It is necessary to treat vascular depositions (plaques) which block more than 70 per cent of the vessel's diameter. "Smaller constrictions do not normally impede the flow of blood nor the supply to the heart," said Dr. Heinz Joachim Büttner, chief physician in the Department of Interventional Cardiology at the Heart Centre in Bad Krozingen.



Schematic representation of a heart catheter examination (Picture: Heart Centre Bad Krozingen)

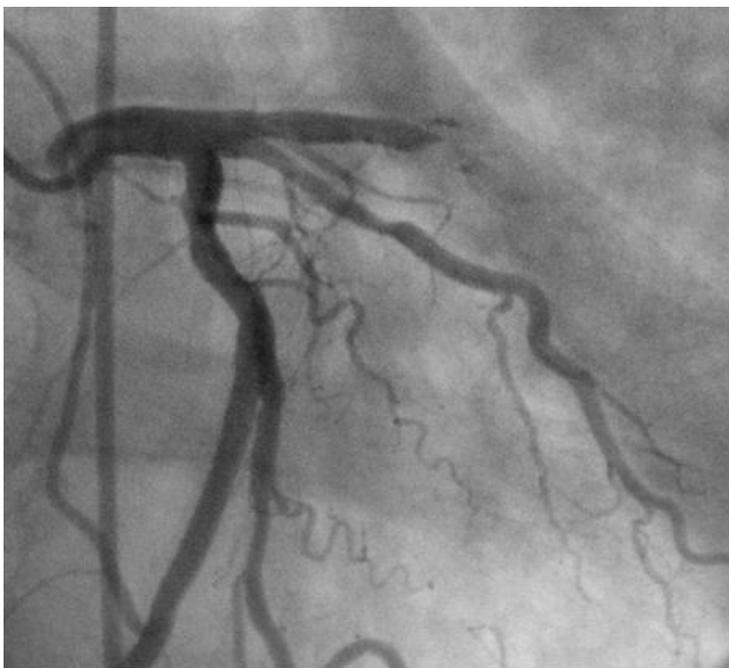
If it is necessary to remove a constriction, then Büttner and his colleagues try to remove the blockage during the very same catheter examination in which they have discovered the obstacle. A balloon at the end of the tube is inflated and expands the vessel. In more than 90 per cent of cases, the cardiologists will insert a stent. The fine metal mesh tubes support the blood vessels and keep the enlarged blood vessel open by pressing the arterial tissue material back in place into the vessel wall. If this site is very calcified, the elevation will be ablated with a drill before the stent is implanted.

Mortality rate decreases significantly

Catheter technology is also used to treat acute cardiac infarction. "Nowadays, a patient suffering a heart attack is admitted to the catheter laboratory right away if his or her situation allows it," said Büttner. The opening of the clogged vessel often saves

the life of the patient. While a few years ago, physicians would use drugs to open up the blood vessel again, mechanical methods are nowadays regarded as the methods of choice. "Many trials and metaanalyses have shown that catheter interventions significantly reduce mortality," said Büttner. That is why international medical societies recommend this type of intervention.

Nowadays, cardiologists and heart surgeons use catheter technology in many other fields. For example, this minimally invasive method can be used to close holes in the atrial diaphragm. It is also possible to renew aortal valves using catheters in patients who are at high-risk from suffering complications during operations. In addition, catheter technology is increasingly used in angiology, a medical field that deals with the treatment or cure of diseases or vessels that are located further away from the heart. It is also possible to treat the causes of cardiac arrhythmia and atrial fibrillation using these fine tubes. The doctors can use specific, high-energy electric pulses to treat the disturbances.



Coronary angiography of a constricted vessel, which has led to acute cardiac infarction (left).



Representation of the same vessel, which has been opened and treated with a stent. (Photo: Heart Centre Bad Krozingen)

Bypass surgery is not superfluous despite the success of catheters

Despite the success achieved with catheter technology, Büttner affirms that heart and bypass surgery have not become superfluous. Bypass surgery involves open-heart surgery during which the flow of blood is diverted. The atherosclerotic narrowing which blocks the coronary heart vessel is bridged with a piece of a vein removed from the upper or lower thigh and subsequently grafted to the coronary arteries before and after the site of constriction.

Previous studies have shown that in diseases affecting several heart vessels, bypass surgery reduces the number of interventions to a greater degree than catheter inventions in which stents are normally used to keep the arteries open. However, many cardiologists hope that next-generation drug-coated stents will be able to change this situation. "The blockage of the left mainstem also requires surgery," said Büttner. Moreover, diabetes patients often benefit from surgical invention. "Diabetes sufferers often have diffuse vascular alterations that cannot be treated with stents," said Büttner explaining that this situation can be improved by bypassing the affected site. In summary, for Büttner there is no doubt: "Catheters make many things possible."

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