IMAGING

Content

#4
An annual publication presented by
ziehm imaging

New directions

It’s been more than 65 years since the invention of the first C-arm. Decades in which the mobile C-arm has evolved from an X-ray machine for simple orthopedic applications, to an intraoperative imaging standard for a wide variety of clinical areas. At Ziehm Imaging, we have never stopped expanding and advancing the C-arm’s applications. Our versatile product portfolio helps physicians around the world continue to make strides in diagnoses and treatment. Learn from Dr. Prasad in India, who successfully operates a mobile ‘Cath Lab’ with the help of our C-arm. Prof. Dr. Veraldi in Italy uses our 3D system for future-oriented treatment of cardio-vascular diseases. Discover how complicated total ankle endoprostheses in Germany are being handled with our C-arms and how new innovations support successful communication in the OR. As a company, we are also forging ahead and adjusting to our rapid growth in recent years: In 2020 we will move into new company head-quarters, which will bring all our employees in Nuremberg under one roof again.

Join us on this journey as a company and pioneer for new clinical applications in the field of intraoperative imaging.

Vice President Global Sales and Marketing
Martin Toernvik

Once considered a Western phenomenon, cardiovascular diseases have become a challenge for the Indian healthcare system. There is an increasing need for cardiological procedures, and most of these are performed in catheter laboratories. Dr. Rajaram Prasad relies on a new concept with a mobile C-arm for the diagnosis and treatment of coronary heart disease.

Learning from India

Photos
Sameer Raichur

Previous page
The SIMS Chellum Hospital was founded in 2015 by a group of doctors in Salem, Tamil Nadu Province, South India. The private institution's goal is providing the population with high-quality and affordable medical care.

Between the Himalayas and the Indian Ocean lies India, the second most populous country in the world. More than 1.37 billion people live here, and population growth continues thanks to progressive modernization and improved healthcare. Western standards are the benchmark for hospitals and practices, and expensive high-end medical technology is finding an increasing number of customers here. But it is not only in this respect that India corresponds with the West. The country is struggling with a growing number of cardiovascular diseases, well-known in the United States and Europe for many years. India plans to master this challenge with so-called 'cath labs.' Here, cath labs are more common than in almost any other country. In the big cities, they are multiplying as fast as mushrooms. The term 'cath lab' refers to an operating room that requires little equipment and in which only minimally invasive procedures are performed. Open surgery does not take place in cath labs; instead, the small surgical units are used, for example, to insert pacemakers or conduct angioplasties, and minimally-invasive tests.

Today, many hospitals in India are installing catheterization laboratories. In Salem, a large city 200 kilometers south of Bangalore in the Indian province of of Tamil Nadu, there are more than ten catheterization laboratories alone. One of them belongs to cardiologist Dr. Rajaram Prasad, whose operating room is located in the SIMS Chellum Hospital. Dr. Prasad founded his cath lab in 2018 to ensure better care for his patients. In a public hospital, people are referred from one department to the other and little or no relationship is established with them, says Dr. Prasad. His own catheterization lab, on the other hand, gives him profound patient contact, from diagnosis to treatment. The decision to go into business for himself was not easy for Dr. Prasad. In addition to finding the suitable premises, financing the project was a major challenge. Purchasing high-end medical technology is expensive, and the purchase of a high-quality fixed system, like an X-ray unit permanently installed in the operating room, which is considered standard imaging in the cath lab, did not seem affordable to Dr. Prasad. "There are

Cardiologist Dr. Rajaram Prasad has been practicing at SIMS Chellum Hospital since 2018. In order to be able to care for his patients holistically, he decided to found a mobile cath lab.

only a few local medical technology manufacturers in India that meet the requirements for cardiovascular interventions. Most systems are imported and are very expensive by our standards," says Dr. Prasad. He therefore began to think about a 'mobile cath lab' in which a mobile high-end C-arm would replace the fixed system. Initially, he was skeptical as to whether the performance of the mobile system would be sufficient for his needs. Although Dr. Prasad had previously worked with mobile C-arms from various manufacturers, the results were not always convincing: "Sometimes the image quality was so poor that I could hardly see the arteries. I was able to achieve good results there as well, but at a certain degree of difficulty in the procedure, it became problematic because the images were too noisy." Dr. Prasad was concerned that a new C-arm could result in similar image quality issues.

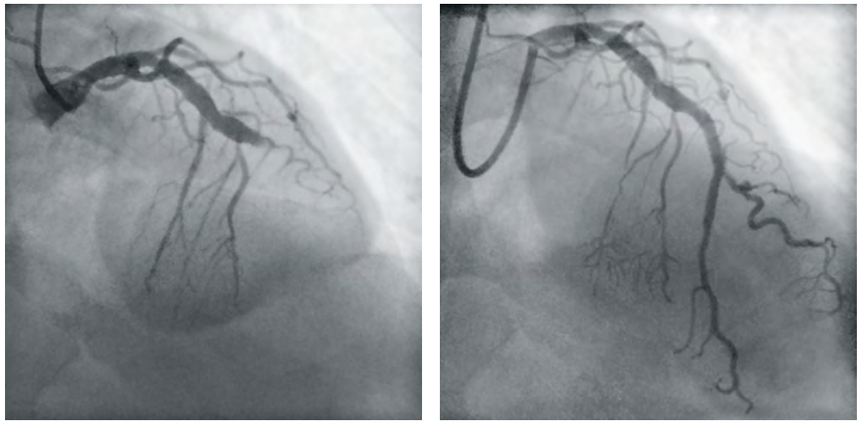
He found the Ziehm Imaging brand during a search for suppliers on the Internet. "My brother is a cardiologist in the USA and warmly recommended the Ziehm system, which is used there in vascular surgery and interventions. He said it was ideal for my procedures," says Dr. Prasad. He was more than surprised when he visited the

With its nine specialist departments and modern operating rooms, the hospital is important to healthcare in Salem. Here, Dr. Prasad prepares for surgery in the anteroom of the cath lab. He also documents the treatment here afterwards, saving valuable space for a separate workstation.

Ziehm Vision RFD Hybrid Edition CMOSline live in Chennai: “The X-ray images had a sharpness and accuracy I did not expect from a mobile C-arm.” Dr. Prasad does not need much space for his mobile cath lab. The C-arm, an operating table, and a ceiling-mounted monitor, which displays the live and reference X-ray images as well as the vital functions of the patient, are easily housed in his operating room. There are three people in the operating room for each procedure: Dr. Prasad is supported by a nurse and a cardiovascular technician. He selects his cases carefully, mainly performing primary angioplasty and stenting, which is the treatment of choice for acute myocardial infarction (heart attack). “Since I operate without a surgical backup, I am more careful about selecting my patients for the procedure. I generally refer patients who have triple vessel disease, left main bifurcation, or a complex coronary anatomy to an institution that is better equipped for cardiovascular surgical procedures, as these patients do better with surgical management,” he says.

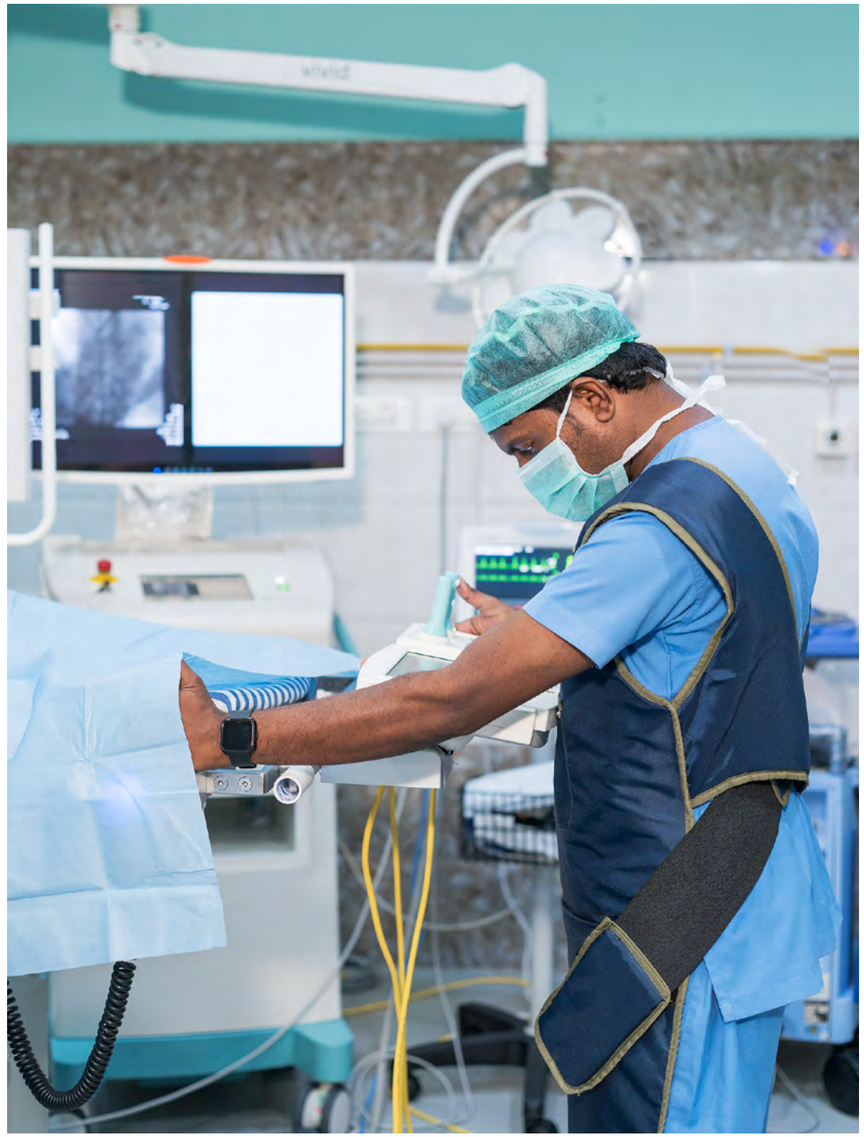
In most cases Dr. Prasad performs an angiogram in the catheter laboratory, i.e., an X-ray of the vessels with a contrast medium, to examine the condition of the vessels. The most common

These angiography images show a complete stenosis of the left main coronary artery (left), and its successful revascularization (right).



procedure is angioplasty, in which narrowed or closed vessels are widened or opened again with balloon dilation, followed by stenting. It is precisely these procedures that aroused Dr. Prasad's interest in cardiology. "Angiograms fascinated me from the beginning of my training. You can see exactly what you did and if you were successful. Good imaging is very important to me because it allows me to measure my results exactly," says Dr. Prasad. For him, it makes no difference whether the images are taken by a fixed system or by his mobile C-arm: "People should not judge the image quality just because it is a mobile C-arm. Initially, I was also skeptical as to whether the image quality could compete with that of a fixed installation. If my colleagues saw the X-rays I acquire in my mobile cath lab, they would think differently. The image quality I get with my C-arm is as good as that of a fixed system and definitely better than any image taken with a low-cost fixed system."

The mobile cath lab has proven to be the right choice for Dr. Prasad. Not only are the acquisition costs of a mobile system lower than those of a fixed installation, but also the maintenance costs, he says: "For fixed installations you need a



Rahul Marcus operates the mobile C-arm during surgery. The specialization of the team and the image quality of the C-arm offer patients a high level of safety.

The mobile cath lab gets by with a small staff: Dr. Prasad is supported in the interventions by an OR nurse and a cardio technician on the mobile C-arm.

high-capacity power supply, which of course costs money. My electricity costs for the mobile cath lab are significantly lower than what I would have with a standard cath lab." In addition, installing a fixed system would require structural changes that are not necessary with his mobile concept. The personnel costs are also manageable, as he only needs an assistant and a cardiovascular technician. Another positive side-effect for Dr. Prasad is the dose-saving work in the operating room, which is very important to him: "It is not possible to estimate the amount of radiation my team is exposed to. That's why it is crucial to have medical technology that is as dose-saving as possible. Ziehm Imaging's C-arm with a CMOS detector is the answer for me."

When asked whether the mobile cath lab has limitations, Dr. Prasad shakes his head: "Our mobile concept has only advantages for me, my employees, and my patients. I haven't had a case that I could have solved better with a fixed system." For him, the mobile cath lab is a model for the future. "Medical imaging is becoming more and more important for us, and it is getting better every day. If we can afford the latest technology, everyone wins."

Prof. Dr. Gian Franco Veraldi and his team at the University Hospital in Verona are specialized in the treatment of vascular surgery, both open and endovascular hybrid techniques.

Certainty in real-time

Professor Dr. Gian Franco Veraldi is developing a future-oriented minimally invasive treatment for cardiovascular diseases at the University Hospital of Verona. With the help of a 3D C-arm from Ziehm Imaging, he can obtain certainty during surgical interventions, thus avoiding revisions and shortening hospital stays for patients.

An abdominal aortic aneurysm in a high-risk patient with an implanted stent. The stent is extended with a stent connection in a minimally invasive procedure.

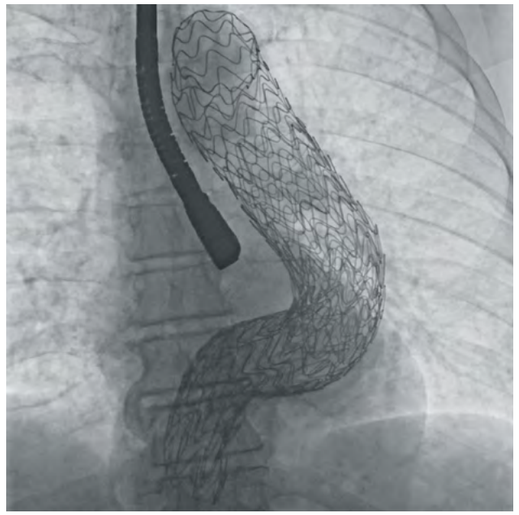
Between the first surgical repair of an abdominal aortic aneurysm (AAA) and today lie almost 70 years. For a long time, the only solution for the often-life-threatening malformations of the aorta was a complicated open surgical procedure. Currently, more and more doctors are advocating minimally invasive treatment of aortic aneurysms. For patients, the new method is much gentler: less blood loss, improved wound healing, and reduced cardiovascular insufficiencies shorten hospital stays in most cases.

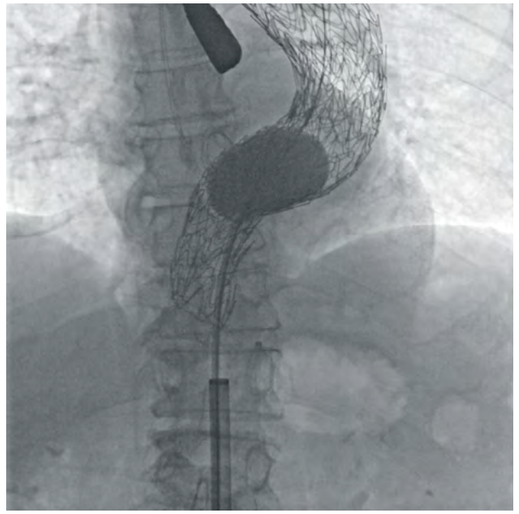
Professor Dr. Gian Franco Veraldi is an expert in this modern method of vascular surgery. With more than 8,000 surgical procedures and a professorship for vascular and cardiac surgery at the University of Verona, he is in high demand, and he radiates professionalism in his daily work: relaxed but concentrated. Today, together with his assistant Dr. Marco Macrì, he is preparing for a minimally invasive treatment of AAA. The patient is in his late 60s and is a high-risk patient. He had a stent implanted several years ago that now has to be extended with a stent connection to treat another aneurysm. For Prof. Dr. Veraldi, the minimally invasive procedure is a sound and important alternative to an open operation. “More than 60 percent of our operations are minimally invasive, i.e., endovascular aortic repair (EVAR). This is the more reliable alternative for us, especially for older patients, as it is gentler and, more importantly, faster than open surgery,” says Prof. Dr. Veraldi.

He and his team have been using the Ziehm Vision RFD 3D CMOSline since early 2019. Although the 3D C-arm was originally designed for complicated procedures in orthopedics, traumatology, and spinal surgery, with its high-resolution 2D imaging capabilities it is equally suitable for multidisciplinary use in vascular surgery and angiography. Prof. Dr. Veraldi therefore operates on the aneurysm with the new C-arm in the usual way for the time being; he does not have to change his routine procedure. The stent graft is introduced via the pelvic arteries into the aorta using a catheter system while under constant 2D X-ray control. Prof. Dr. Veraldi places the stent in the affected vascular section – precise to the millimeter. For optimum adaptation and sealing of the prosthesis in the vessel, the stent is pressed against the aortic wall using a dilatable balloon. It is particularly important that the renal arteries are not covered by the stent in order to maintain supply to the organ, and that a piece of the new implant overlaps the existing stent.

“The combination of high-end 2D imaging and innovative intraoperative 3D stent control in one system allows us to optimize proven surgical techniques in the field of vascular surgery.”

In the past, the usual method of intraoperative control angiography often did not give Prof. Dr. Veraldi the assurance he needed, and he had to rely on his experience. Normally, he would have been able to close the patient following a final contrast agent angiogram. After a few days a postoperative CT would have been performed to check the location, the correct opening of the stent, and whether there was sufficient blood supply to the aorta and adjacent vessels. If the postoperative exam had shown that something was not 100 percent correct, the patient would have had to undergo a corrective intervention. “This was always unsatisfactory for me,” says Prof. Dr. Veraldi. “The postoperative CT scan to verify the result of the operation is still considered the gold standard today. However, it does not give us any certainty during the procedure that our work has been successful.”

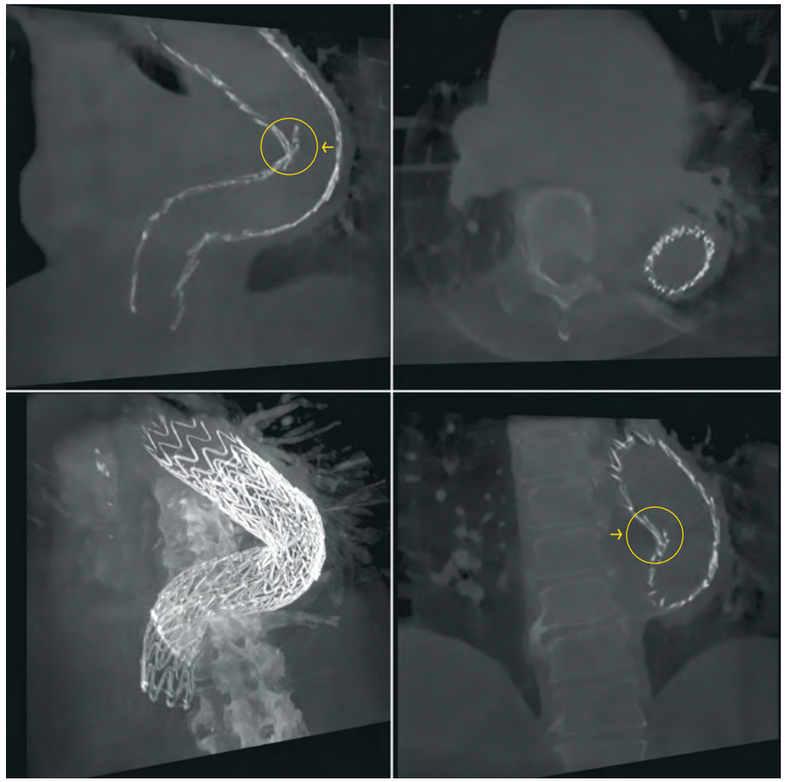




Left
2D view of the stent after opening. In the next step, the relevant site is successively dilated using a balloon to ensure a clean transition to the existing stent and ideal attachment to the aortic wall.

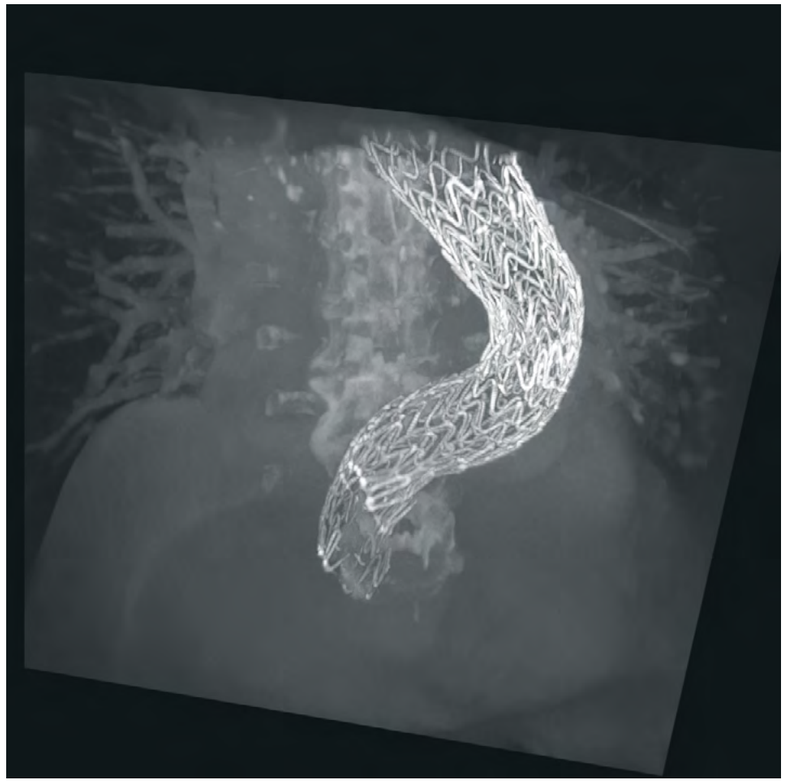
Right
The 3D control image shows that the stent has not yet been optimally connected to the adjacent stent. The decision is taken intraoperatively to improve the result with a new ballooning.

"In the past, after stent placement and the final contrast angiogram, we had to wait days for the postoperative CT. This was always unsatisfactory for me. Today we proceed differently. After the placement of the stent, we perform an intraoperative 3D scan, which gives us the opportunity to check. If necessary we can immediately make improvements."



"Today, in three out of four cases, thanks to intraoperative 3D monitoring, we adjust our treatment strategy during the operation. This will reduce the number of revision operations and shorten hospital stays."

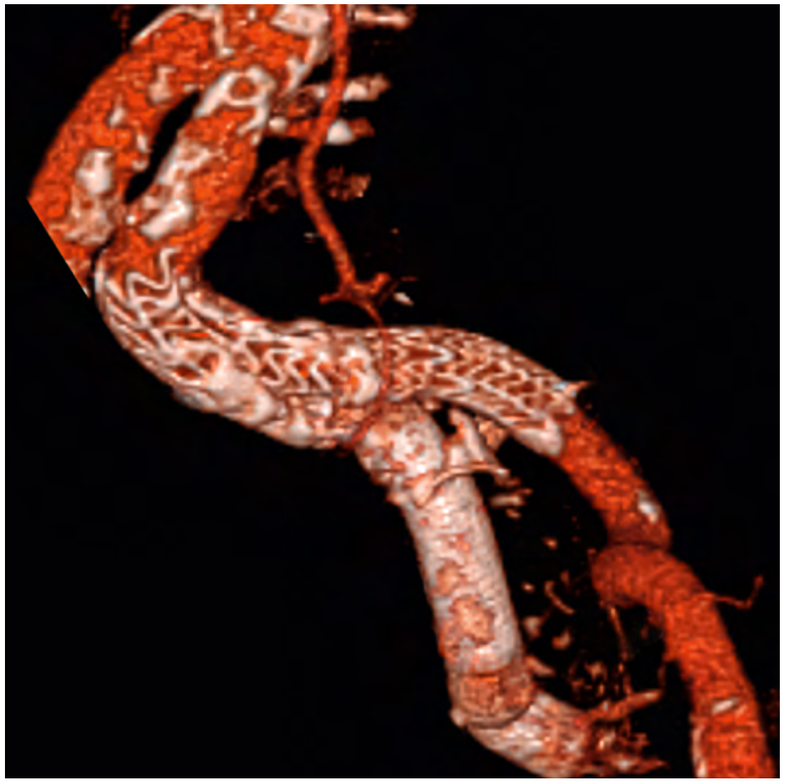
With the mobile 3D C-arm, Prof. Dr. Veraldi now has a new opportunity: "3D imaging allows us to conduct an intraoperative check on the stent placement. This enables us to confirm whether the stent has unfolded optimally after the vascular procedure has been completed – even while the patient is still under anesthesia. There is no need to wait for the postoperative CT. And we can immediately be sure that we have worked precisely," says Prof. Dr. Veraldi. This innovative additional step in the EVAR procedure not only enables better surgical results, but is also safer. "If the 3D scan shows that we have to inflate the balloon a little more to achieve perfect results, for example, we can decide this immediately and adapt our surgical procedure accordingly." A final 3D scan then shows whether the stent is perfectly placed, and the operation can be successfully completed. Thanks to this new treatment method, patients can be discharged from the hospital after just a few days.



“Currently, the postoperative CT scan is regarded as the gold standard for verifying surgical results after an EVAR procedure. The comparison of the intraoperative 3D scan and the postoperative control image from the CT shows us, however, that we now have the same options intraoperatively as postoperatively. This not only makes us more efficient, but also saves lives in extreme cases.”

Above
Final 3D image of a complicated endovascular aortic repair. With the intraoperative control option, EVAR procedures can now be completed much more safely.

Right
Postoperative CT control image. For Prof. Dr. Gian Franco Veraldi, the image quality of the C-arm is decisive for the success of the operation. It makes the postoperative CT scan unnecessary.



For Prof. Dr. Veraldi, the 3D scan has become the standard procedure for the treatment of complicated aneurysms. The head of vascular surgery is convinced by the possibility of immediately recognizing whether all measures have been successful, even during challenging operations. “We now have the same options intraoperatively as we otherwise only had in a postoperative CT.”

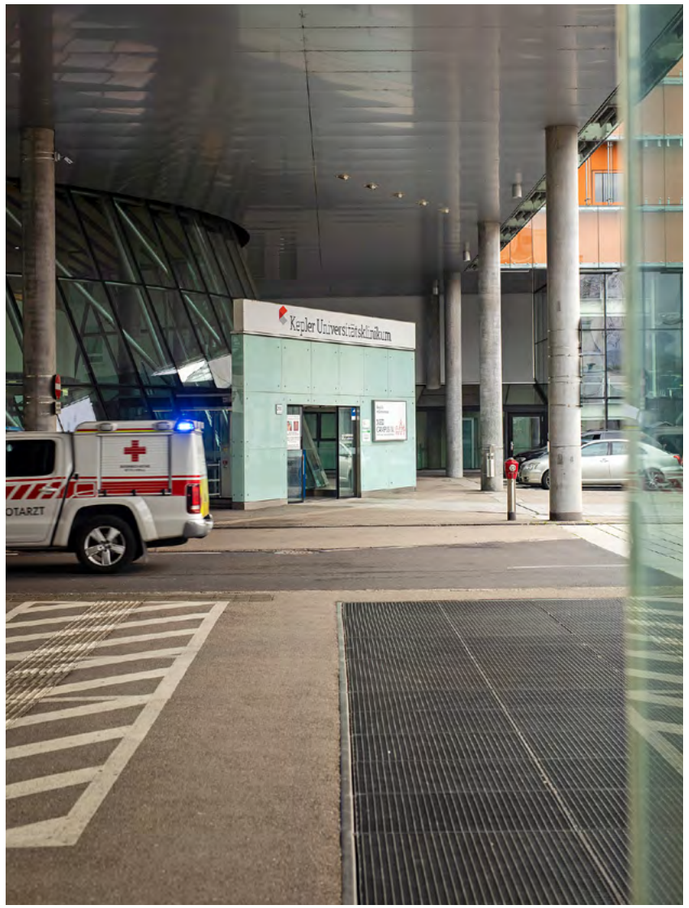
“Now we can finally see in real time what we used to have to wait several days for.” For Prof. Dr. Veraldi, this is not only an important additional benefit. He thinks that the 3D control scan will help spread and more widely establish the EVAR procedure. The number of open operations, but above all the number of revisions, would decrease significantly as a result. “We can hardly expect more from today’s technology. It offers us an excellent advance in minimally invasive AAA treatment and helps us not only increase our efficiency, but also improve the lives of our patients.”

Medical technology thrives on close collaboration between engineers, business managers, and clinical personnel. Bernhard Hochholdinger and Norbert Lechner talked to us at the Kepler University Hospital in Linz, Austria, about the growing importance of medical technology for the efficiency and profitability of modern hospitals.

Operating the system

Photos
Simeon Johnke

Entrance to the Med Campus IV of the Kepler University Hospital (KUK), a high-performance medical center for around 1.5 million people in Upper Austria.



Bernhard Hochholdinger, M. Eng.
— BH
Head of Medical Technology at Upper Austrian Health Holding (Oberösterreichische Gesundheitsholding GmbH) and Head of the Medical Technology Division at Kepler University Hospital, he is responsible for the innovative technology of all the clinics in the network.

Norbert Lechner, Eng.
— NL
The engineer manages a part of the medical technology department at the Kepler University Hospital in Linz and works with his team every day to ensure that numerous imaging systems function seamlessly. He is also a lecturer in medical technology.

Mr. Hochholdinger, you are in charge of medical technology at Upper Austrian Health Holding. How did this come about?

BH In 2003, I started working for the former General Hospital (Allgemeines Krankenhaus AKh) of the city of Linz as a project manager for medical technology. 13 years later the AKh, the Regional Women's and Children's Hospital and the Wagner-Jauregg-Hospital merged to form the Kepler University Hospital (KUK). In 2017, I took over the management of the Medical Technology and Medical Informatics Division. Since the integration of KUK into the Upper Austrian Health Holding in July 2019, my team and I have been responsible for the medical technology of the entire holding.

What role does Upper Austrian Health Holding play in Austria?

BH With around 14,500 employees, the holding company is Upper Austria's largest hospital operator and, in addition to the Kepler University Hospital, operates five other regional clinics at eight locations.

How is Kepler University Hospital different from other healthcare providers?

BH With around 6,500 employees and approximately 1,800 beds, the KUK is Austria's second largest hospital, and the central healthcare provider for the city of Linz and the entire region. It covers the clinical spectrum including all departments and chairs. The close connection to the medical faculty at Johannes Kepler University enables new ways of teaching and offers many opportunities in the field of research and development. The campus character of the hospital creates an optimum setting for efficient work and flexibility. With the exception of the Neuromed campus, which is located at a different location in Linz, the buildings on the Med campus are connected by underground supply routes as well as above-ground corridors. The narrow glass passages between the buildings, which we internally call 'the lion's walk,' are a symbol of networking.

Mr. Lechner, you are an important contact person for medical technology at KUK. How did you grow into this role?

NL After eight years in the field of X-ray technology, I started my career in 1998 in the former AKh Linz as a 'one-man-show.' I started as the first X-ray technician in the company. Over a period of five or six years, I was able to build up a small medical technology division with two employees that is responsible for all imaging procedures. At the moment, we support the Med campus with about 150 systems, from CT and MRI systems, angiography and X-ray workstations, to ultrasound equipment and C-arms. Besides the practical work with the equipment, teaching is very important to me. Lectures and courses have long been an integral part of my work.

What are the main responsibilities and daily tasks in the Medical Technology Department?

BH Ensuring the functional and operational safety of all medical devices is one of our central tasks. We are responsible for budget control, coordination, implementation, and monitoring of maintenance, repairs, and safety inspections. Due to our technical expertise, we are not only the contact for medical personnel, but also for the purchasing department of the clinic. We are closely involved in the procurement process. In addition, collaboration with research and teaching is becoming more and more important. The introduction of new technologies and collaboration and joint development with companies is essential for the KUK.

What is your role in the procurement, operation, and maintenance of mobile C-arms?

NL Our core competence lies first and foremost in maintaining operations, like repairing, testing, and maintaining the C-arms. So we are in regular contact with the respective manufacturers. What distinguishes our medical technology, however, is the expertise that enables us to carry out work independently on site. This sets us apart from other hospitals. In addition, we constantly observe and analyze the market in order to be able to provide qualified advice to doctors and procurers when making new acquisitions. We keep ourselves informed about the latest developments by following congresses such as the RSNA or ECR.

How are you involved in the decision and purchase processes for a mobile C-arm?

BH The medical technology department is an important pillar for the hospital operator and is involved in the clinic's mid-term budget planning processes. Our expertise on device cycles, spare parts supply, or manufacturer end-of-life data is both necessary and desirable.

How does such a decision-making process work?

NL With us, new or replacement procurement always begins with user discussions: In the run-up, we get feedback from users such as doctors, operating room nurses, department and clinic managers, and gather information about possible preferences. We consider and discuss the field of application, special requirements and experiences, but also the latest studies on systems from different manufacturers. With this level of knowledge, we can compile a selection of suitable imaging systems. On the basis of user discussions and empirical values, a concept for investment planning is created and implemented in cooperation with investment management and purchasing.

What are the advantages of this process?

NL To a certain extent, independent consultants for tenders are always market driven. The KUK's internal consulting expertise in medical technology is essential for successful investment planning. Another decisive advantage is the presence of our department on site. We're on hand as the systems age: The first step is the integration of the devices accompanied, for example, by fine tuning, and continues until the technology is bug-free. Later, maintenance and repairs become necessary. We are therefore in ongoing contact with the nurses, doctors, or radiologists who operate the equipment. This enables us to evaluate and document the fulfilment of the requirements or the handling of the equipment.

BH The consulting, support, and concept development for investment planning within KUK is excellent and offers many advantages. It is particularly important for us to keep and promote the medical technology expertise in our company in order to guarantee the best possible advice for the various specialist departments. Mr. Lechner's statement applies to the entire holding. In the holding company, the medical technology department within the Technical Directorate of the Upper Austrian Health Holding is the point of contact for all relevant medical technology issues. The aim now is to bring the KUK's experience and functioning processes into the holding company. Since we are constantly gathering experience in medical technology from the various companies, we can immediately suggest suitable devices for procurement, supported by a loan device process for testing new types of devices.

What criteria is used to select a C-arm?

NL Our advice is always tailored to specific users and their area of application. Of course, when selecting a new C-arm, we always pay attention to criteria such as adequate image quality, radiation dose, efficiency, or the appropriate detector size. Standardization across all specialist areas is also necessary.

BH The latest technology is important to us, especially as limited financial or human resources call for modern technologies and innovations that support the hospital in the best possible way and over a long service life. Here, too, the merger of the hospitals offers an excellent opportunity: Regional clinics benefit from innovative equipment. The challenge in purchasing new systems is always a balancing act between the latest technology and the maturity of the product – we want to avoid 'green bananas.'

You mentioned the dose as well as the image quality. What role does it play in the decision-making process?

NL Dose is highly relevant for us. The KUK is the European leader in pediatric heart diagnostics and surgery. In this highly sensitive area, we have to keep dose values as low as possible. Although the dose curve has been steadily decreasing over the past 20 years, the new CMOS detector technology has been a significant and welcome leap forward. In order to ensure that we use C-arms that are as dose-saving as possible, we carry out our own dose measurements on site, check different C-arms from different suppliers, and compare our measurements with the information provided by the manufacturers. This procedure distinguishes our medical technology department from many other institutions. It enables us to expand our know-how and make our own decisions. We can measure realistic values that correspond to our OR operation and it's prevailing requirements. Ultimately, the dose factor is a factor in the purchasing decision, and was the main argument for a Ziehm Imaging C-arm in a specific neonatology case, for example.

How does maintenance and repair work at KUK?

NL Due to our professional competence, our maintenance department handles most of the maintenance work itself. This enables us to react quickly and flexibly, ensuring that users receive the best possible support. We are trained to be able to carry out this work

Bernhard Hochholdinger is the head of medical technology at the Upper Austrian Health Holding and, in addition to the Kepler University Hospital, also manages five regional clinics at eight locations. His goal is to bring the KUK's experience and processes into the holding company.

Norbert Lechner initiated the established processes and expertise of the medical technology department at the Kepler University Hospital.
He started 21 years ago as an X-ray technician at the General Hospital of the city of Linz where he established a specialist department, and now passes on his well-founded know-how to junior staff in lectures and seminars.

properly, for example by the Ziehm Academy in Nuremberg. Of course, we are also in regular contact with manufacturers like Ziehm Imaging when it comes to spare parts, for example. We also have maintenance contracts with manufacturers in various forms. Service, and above all a personal contact person, are particularly important to us. Ziehm Imaging offers what we need: The service is based on personal contact, and response times are short. This enables us to act and solve technical problems quickly and reliably.

What medical technology trends do you see in the future?

BH More and more trends are emerging that serve the cross-departmental buzzwords ‘flexibility’ and ‘efficiency.’ Against this background, mobile, space-saving solutions are becoming increasingly important. With them, economically-sound process flows can be optimally designed for patients and clinical personnel. Significant improvements in software will change and support diagnostics and treatment in the future. System functions that we cannot currently manually configure and take advantage of due to time constraints are being simplified more and more with the help of automatic presettings. Robotic-assisted surgery will increase: In the future, interaction with innovative devices will be possible, and necessary, in everyday life. Artificial intelligence is also likely to be a major driver in medical technology. This rapidly growing field will play a major role in imaging diagnostics.

What does this mean with regard to mobile C-arms?

BH Compared to mobile C-arms, stationary systems are still in the majority, for example, for heart operations. In the past, fixed systems were considered state-of-the-art; today, there is hardly any difference to the mobile systems. Solutions such as those from Ziehm Imaging deliver comparable image quality and offer additional advantages under the high pressure for efficiency, such as optimum utilization of the operating rooms, the use of hybrid operating rooms, and the possibility of multidisciplinary as well as intraoperative interventions. In the future, people will have to work more flexibly and switch between operating rooms more frequently. For this reason, the trend will clearly be towards mobile devices. Especially in the application of C-arms, intraoperative navigation with 3D images is becoming more and more important. The possibility to display different modalities together and the overlay of instrument navigation are the future.

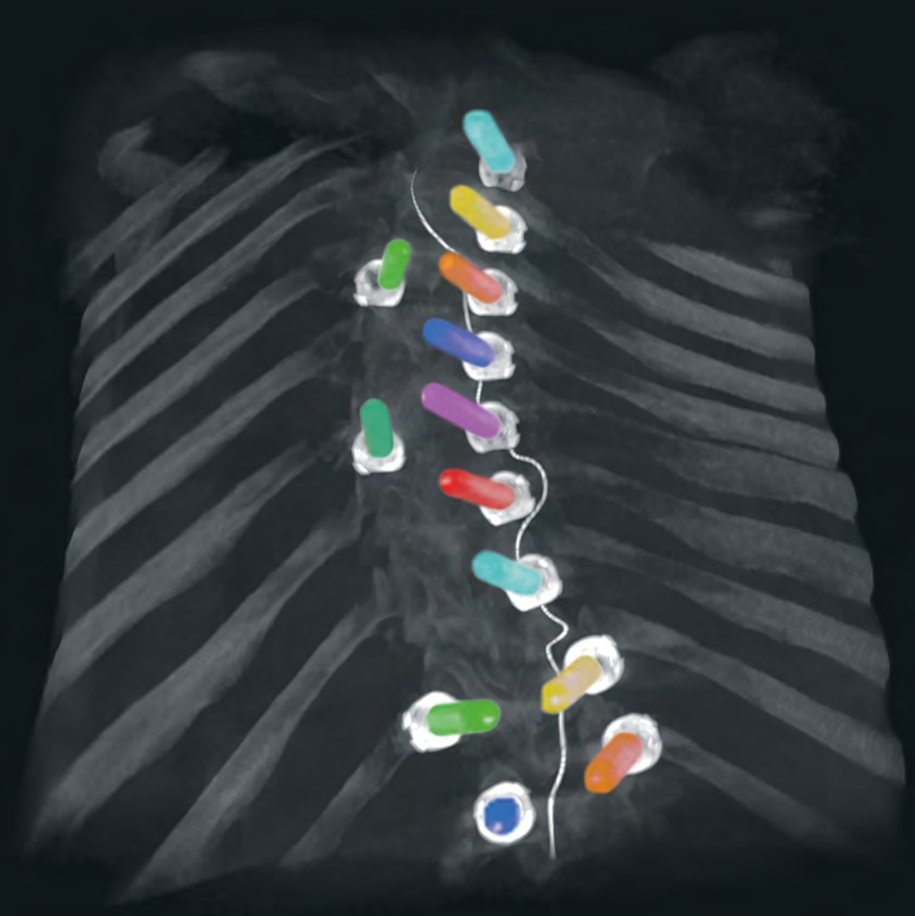
NL An additional, clearly-emerging trend is towards C-arms without monitor trolleys, like the Ziehm Solo FD. With the help of video distributors, it is now possible to wirelessly transmit the image to any monitor in the room without loss of quality. The important information is thus visible to doctors and assistants, and we have one less device to worry about in the operating room.

Medical technology today and in the future: What difference does your profession make?

NL I am convinced that nowhere else can technology be used more meaningfully than in the field of medicine. Our work is highly innovative, there is hardly any routine. The transfer of knowledge is also varied and an important basis for us to train young medical technicians for the future.

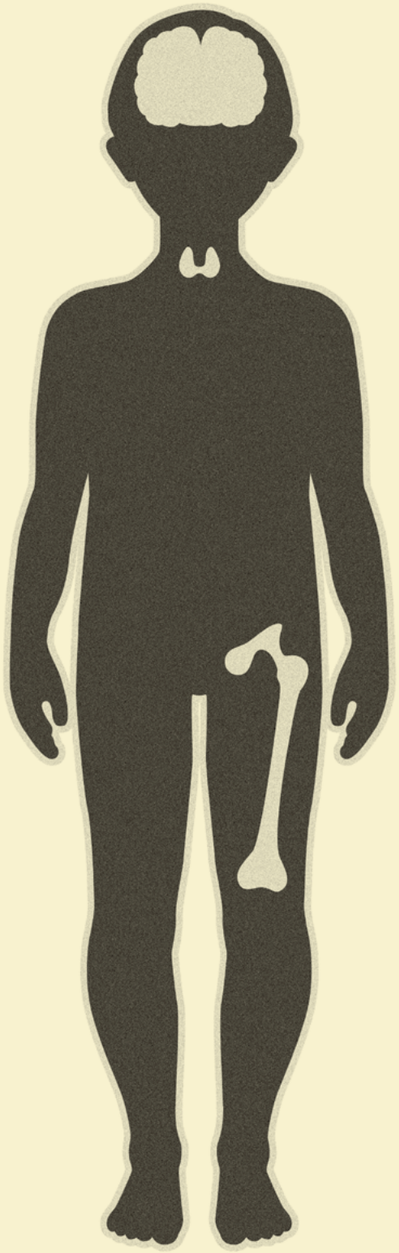
BH Leaps in technical innovation and digitalization create a new working environment. In this dynamic environment, I see an opportunity to expand the holding company’s potential and exploit the opportunities offered by the merger for medical technology. For me, it is attractive to work at the forefront of this field, and to be able to actively shape the future.

Thoracic spondylodesis (T3-T11) for the treatment of idiopathic scoliosis, aquired with a Ziehm Vision RFD 3D CMOSline[1].



Intraoperative 3D imaging has become indispensable in spinal surgery. It enables the surgeon to check results during the ongoing operation. The simple and exact assessment of the implant positioning is particularly important. In addition to proven technologies for optimum differentiation between soft tissues and bone structures, a new software feature from Ziehm Imaging provides further assistance in the demanding OR routine: Enhanced Screw Visualization[2] displays the screws in different colors in a live image. This means the surgeon can immediately recognize and differentiate between implants, ensuring clear and unambiguous communication during complicated spinal fusions. Complex scoliosis, and traumatologic spinal injuries can be surgically treated precisely and safely.

Image of the year

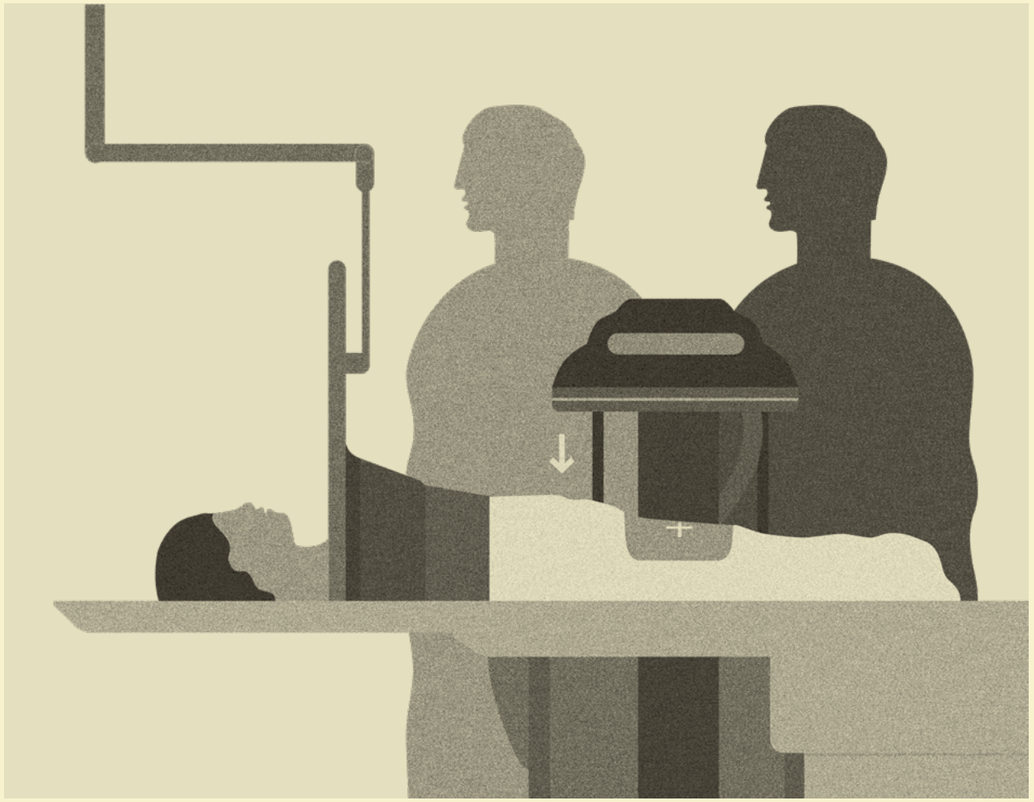


SmartDose

As a manufacturer of mobile X-ray equipment, Ziehm Imaging fully supports the fundament and principles of ALARA and organizations such as ImageGently. Ziehm Imaging's comprehensive SmartDose concept offers solutions for the best compromise between good image quality and low dose – such as a removable grid, a manually adjustable pulse frequency, and radiation-free positioning of the collimators.

Radiation protection in pediatrics

Children have a higher risk of developing cancer after exposure to radiation than adults. This makes it even more important for physicians to minimize radiation exposure for children, insofar as it is compatible with meaningful diagnostics and therapy. We, as manufacturers of X-ray systems, can aid hospital staff in their everyday work with hardware and software solutions to contribute to this end.



1

Mastering the basics of X-rays

- **Apply the ALARA principle**

‘As low as reasonably achievable,’ or ALARA, is a global radiation protection principle for the optimized use of radiation. Basically, it means that radiation should be used as judiciously as possible on humans, animals, and materials. ‘Judiciously’ means that every dose should be as low as possible, considering all advantages and disadvantages. Especially in pediatrics, the ALARA principle is of highest priority.

- **Avoiding unnecessary radiation**

With every X-ray, but especially when imaging children, it is important to use radiation with special care. This means that radiation should be conducive for the success of the therapy goals: Is fluoroscopy absolutely necessary? Are there alternatives, such as the possibility of radiation-free magnetic resonance imaging or ultrasound? The answers to these questions must be weighed carefully.

- **Protect all sensitive areas**

The region of interest (ROI) is the area of relevance to be examined. It should always be as small as possible, because this keeps radiation exposure as low as possible. Everything outside the ROI is shielded by special lead blankets. In children, skin, brain, eyes, thyroid and gonad glands, as well as breast and bone marrow should be especially protected.

- **Keep fluoroscopy exposure times brief**

If radiation has to be used, exposure should be as brief as possible. With current technology, some presettings of the system can be changed without X-ray exposure. This allows targeted radiation, and the fluoroscopy exposure time is limited.

- **Working close to the detector**

Positioning the detector as close to the patient as possible has several advantages: image quality is better, the dose is reduced, and the field of view (FOV) is extended. Scattered radiation is also significantly reduced, which is beneficial for the staff, in particular.

2

Correct use of the latest technology

- **Pulsed fluoroscopy**

In some countries, pulsed fluoroscopy is standard for pediatric fluoroscopy due to legal requirements. However, the correct application with individual reduction of the pulse rates is important. Thanks to new Ziehm technologies, image quality comparable to that achieved with high pulse rates can be acquired at low pulse rates.

- **Using innovative technologies**

Pediatric procedures should be carried out with the latest technology – in recent years, aspects such as dose management, and applications supporting ease of use and image-quality optimization have been continuously improved. Ziehm C-arms not only deliver very good image quality, but also improved copper and carbon pre-filtering. This is responsible for increased hardening of the X-ray beam, which in turn leads to a reduced skin entrance dose. In addition, all Ziehm Imaging CMOSline devices come with a ‘Low Dose Mode’ presetting.

3

Optimizing C-arm settings

- **Radiation-free patient positioning**

The laser can help determine the region of interest (ROI) without using any radiation. The C-arm is thus positioned quickly and optimally without additional dose. The virtual collimators can be set asymmetrically to the ROI on the touch screen with just one hand. The smallest possible radiation field is then displayed for capturing the image.

- **Using special anatomical programs**

Ziehm C-arms offer various so-called ‘anatomical programs’ (APR) for each important body region. These programs are optimized for the respective area in terms of image quality and dose. In addition to the APRs, patient-specific options can be selected with modifiers. The modifiers can also be used to activate further dose-reducing options for children. In addition, there is a low-dose button that is always activated during a pediatric examination.

- **Applying magnification modes**

In the so-called ‘MagModes,’ an enlarged view of the relevant anatomy can be achieved at the same dose. Another advantage of the magnification modes is the irradiation of a small area. The higher resolution and the lower noise of the CMOS detector also allow a more precise image without increasing the dose.

- **Dilute contrast medium**

If a contrast medium has to be used, high image quality can also be achieved with diluted contrast medium. This reduces the strain on the body.

- **Removing the anti-scatter grid**

Due to their smaller anatomies, the scattered radiation created during fluoroscopy of children or other small patients is significantly lower. Therefore, the anti-scatter grid can be removed for pediatric or other dose-sensitive applications. Nevertheless, excellent image quality can be achieved with a significantly lower dose.

Photos
Simeon Johnke

8:10 a.m.

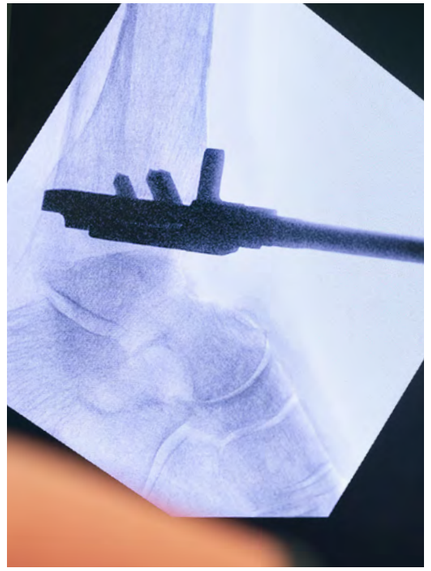
Chief physician Dr. Ulf Bertram and his team at the Vulpius Clinic in Bad Rappenau treat more than 3,000 patients with foot injuries every year. The complicated biomechanics of the upper ankle make the perfect insertion of an endoprosthesis the ultimate challenge in foot surgery. Precise work and constant intraoperative control are indispensable so that the patient can walk without discomfort after the operation.

8:25

While Dr. Bertram removes the damaged arthrotic joint sections of the tibia and the talus, the mini C-arm is prepared for its first use. The two OR nurses pack the Orthoscan FD Pulse and the wireless foot switch in a, sterile disposable drape. Both components can then be used directly in the operating field and managed by the surgeon himself. The clinic not only saves time, but also extra costs for additional operating room personnel who would otherwise have to operate the C-arm during the procedure.

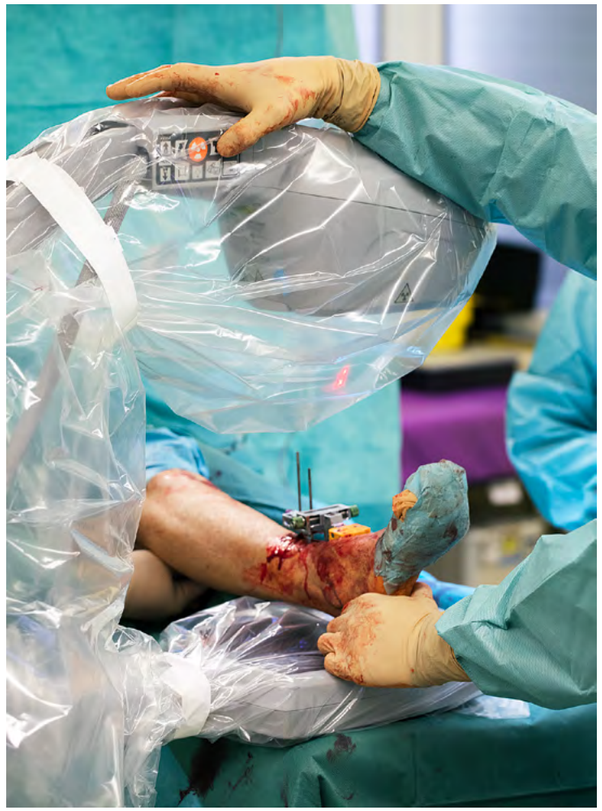
8:27

8:31



Using a template, Dr. Bertram examines the anatomical structure in order to determine the positioning of the implants later. The foot is x-rayed with the mini C-arm in the lateral and AP positions. With its straight underside, the flat detector can be easily positioned on the operating table for AP-imaging (left). The detector size (15 × 15 centimeters) facilitates optimal imaging. After implanting the tibial component, Dr. Bertram checks if the position and size is correct with the help of the X-ray images (right).

8:35



By inserting a trial implant where the prosthesis will later be placed, Dr. Bertram tests the best size and position of the total ankle endoprosthesis. Using the bilateral control modules on the mini C-arm generator, he can not only trigger the X-rays himself, but also rotate and store the images so that he can view the images that are relevant to him at any time during the operation. In this way, Dr. Bertram is able to adjust each X-ray image to his preferred view and saves valuable operating time because he can operate the equipment by himself.

8:45

Dr. Bertram pulls the mini C-arm towards himself in one movement. The low weight of the system and the sterile handle make it possible to precisely position the mini C-arm with one hand. The mini C-arm is often used for complicated procedures like the implantation of a total ankle endoprosthesis. For a control image, the foot is lifted briefly, and the device is pulled up and positioned under the foot. Dr. Bertram then rotates the system to a horizontal position for a lateral exposure. The system's maneuverability enables him to easily push the mini C-arm back and forth.

9:39

9:41

Dr. Bertram examines his results with a final image: He can check the correct positioning of the cobalt-chrome implants on the tibia and talus with the help of X-rays (left). The final image shows him the precise position of the endoprosthesis in the ankle joint (right). The mobility of the polyethylene inlay connecting the implants is satisfactory. After two and a half hours, head physician Dr. Ulf Bertram and his team complete the complex procedure. Approximately six weeks after the operation, the patient will be able to put weight on the foot again.

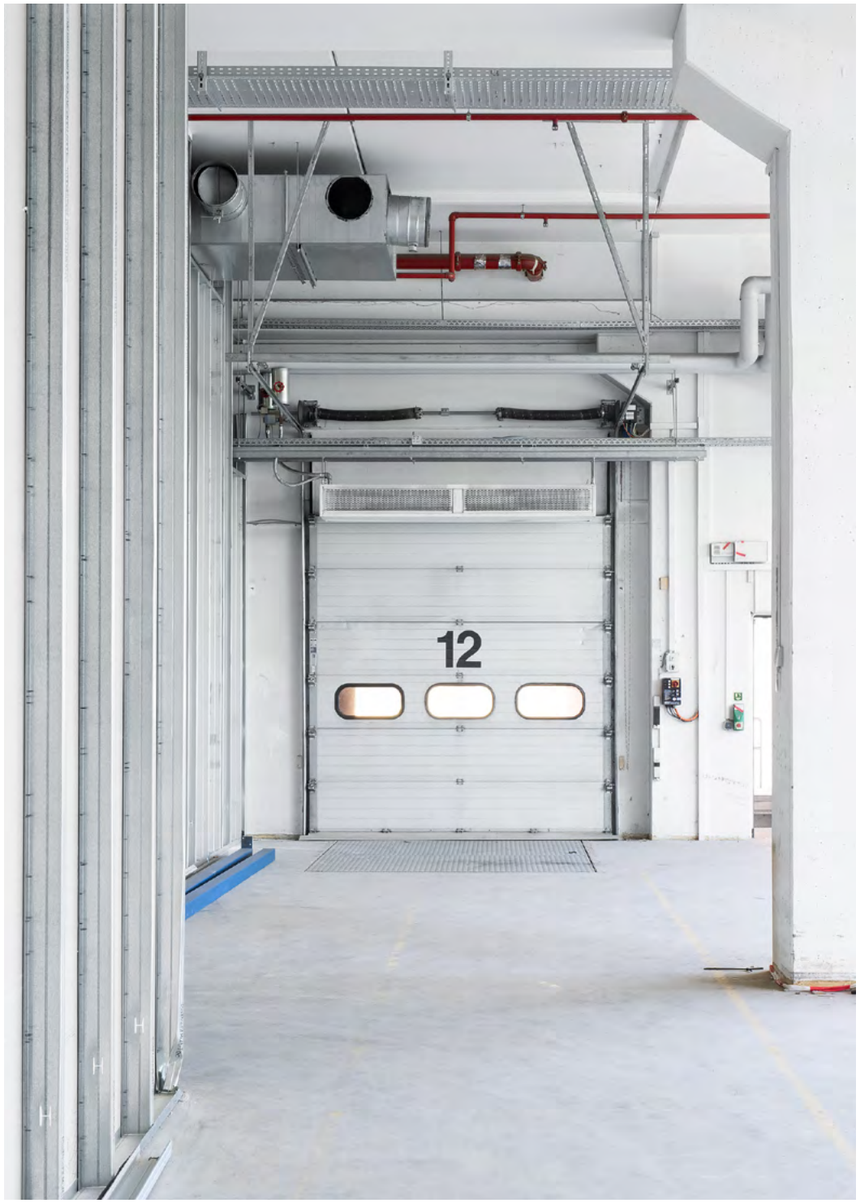
9:45

Chief physician Dr. Ulf Bertram is an expert for orthopedics, traumatology, and pain management in foot and ankle surgery at the Vulpius Clinic in Bad Rappenau. Performing approximately 1,000 operations per year, he is considered to be a specialist in Germany for foot and ankle surgery. During the operations, he uses the mini C-arm Orthoscan FD Pulse as an imaging system for implant control. Since 2017, Ziehm Imaging has had full distribution rights for the mini C-arms of its American subsidiary Orthoscan Inc. in Europe, the Middle East, and Africa.

From the waterfront to the southeast: Ziehm Imaging remains loyal to its roots in Nuremberg. In 2020, we are moving our international headquarters to a future-oriented business park close to the Nuremberg Exhibition Center. The new location is spacious and, after renovation, will provide a modern space for working and innovation. At the previous location, the departments were divided between four buildings; now, all employees will be reunited.

Under one roof

Photos
Juli Sing



The still empty halls give a first impression of the new building's spaciousness. Twice as large as the former headquarters, there is plenty of room for staff and systems.

Our 'gateway to the world': After the remodeling of the facility is complete, the C-arms, which are manufactured in many steps, are shipped to customers around the world through this exit.

Between the production and reception area, potential new Ziehm employees will be welcomed.

Currently storage space for construction materials, all the threads of the production process will soon will soon converge in the Head of Production's office.

There are 14 separate shielded testing rooms next to each other. The ample space in front of them will be used for production.

The renovation work is progressing rapidly. For comparison: three weeks earlier, these rooms were still in dry construction.

Previously, only one of nine C-arms manufactured for the pilot series was located here. In the future, numerous systems will be lined up in this space.

Clear walkways and generous spaces – an initial setup for the certification of the production site shows the size of the production areas.

It still takes imagination to envision a showroom here. After the remodeling, this will be the exhibit space for our technical innovations.

On the second floor, rooms with a view to the future are being created. From mid-2020, the management command center will be located here.

Cover
Percutaneous transluminal coronary angiography,
acquired at SIMS Chellum Hospital, India,
with a Ziehm Vision RFD Hybrid Edition CMOSline.

1 / page 28
CMOSline represents a system configuration that is based
on a Ziehm Imaging CMOS flat-panel detector.

2 / page 29
The product mentioned herein is currently under development
and will be released with software NGP 7.07.0.

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2020

ziehm imaging

Ziehm Imaging is specialized in the development and manufacture of mobile C-arms. For more than 45 years, we have produced technologies that enhance imaging and streamline clinical workflows. The mobile X-ray devices' exceptional image quality and flexibility in the operating room serve as an important basis for treatment success.