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Cios Alpha: Flat Detector Mobile C-Arm Imaging in Advanced Endovascular Surgery

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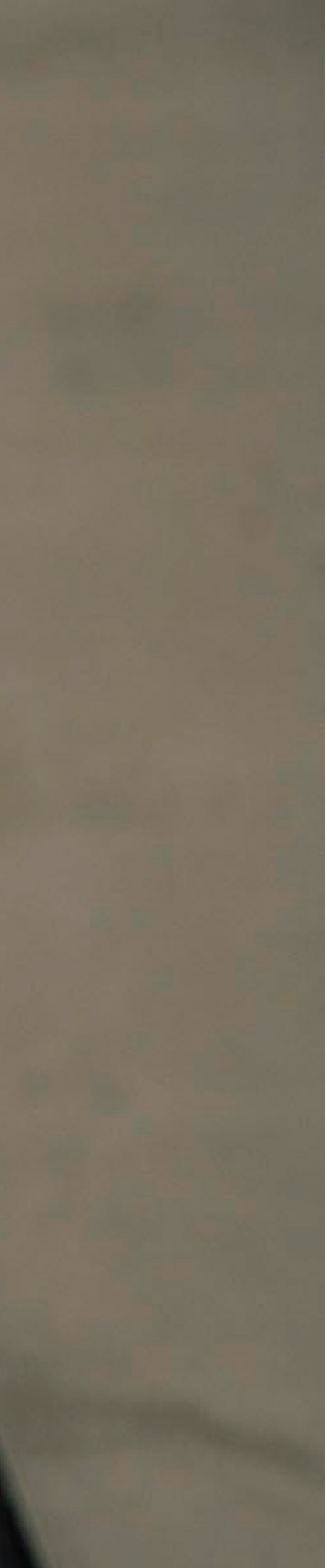
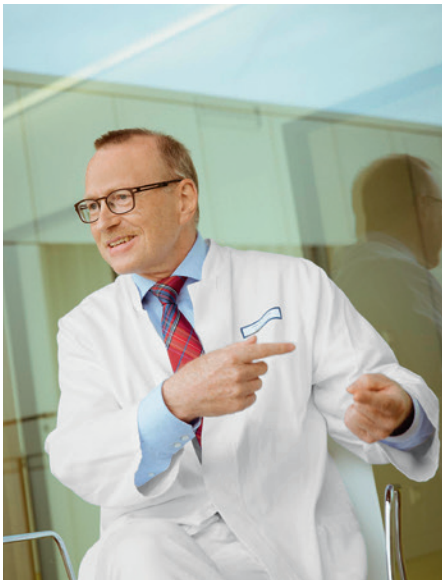


Precise Images in the Operating Room:

The Mobile C-Arm Cios Alpha

Demands placed by vascular surgeons on intraoperative imaging are high and diverse. Prerequisites include outstanding image quality and a flexible scope of application from head to foot during elective operations and emergency procedures. Surgeons also wish to operate the X-ray system in person. The team headed by Professor Werner Lang at the University Hospital in Erlangen, Germany, tested Cios Alpha, the first mobile C-arm from Siemens equipped with a flat detector, and came to the conclusion that the device is a multitalent.

Text: **Matthias Manych** Photos: **Sven Doering**



Professor Lang and his colleagues examined Cios Alpha for six weeks, with two to three procedures performed each day.

A primarily endovascular approach is gaining rapid popularity within diverse areas of modern vascular therapy. Professor Werner Lang cites stenosis treatment in the pelvic artery as one example of this trend: “The classic Y-prosthesis from the aorta to both leg arteries is hardly in use anymore, as the catheter procedure yields such good results.” Another fast-expanding field is the treatment of the lower-leg arteries. Specialized stents such as fenestrated and branched aortic stent grafts are now being used in endovascular procedures with increasing frequency. The key to the successful implementation of endovascular therapy options is intraoperative imaging, and its most important tool outside hybrid operating rooms is the mobile C-arm.

Precise, Rapid Image Acquisition with Lower Radiation Dose

One of the crucial technical prerequisites for modern vascular surgery is the image quality produced by the mobile X-ray system. With a spatial resolution of 1,500 times 1,500 pixels over a field of view of 30 times 30 centimeters and 25 percent larger than conventional image intensifiers, Cios Alpha’s flat detector (FD) offers precisely the distortion-free structural displays expected and required by vascular surgeons like Professor Lang. And, thanks to the patented active cooling system for the X-ray tubes, this is now possible, even during long procedures. Intraoperative control is particularly important to Professor Lang, who states: “In the operating room, I need to be certain that the prosthesis is positioned correctly.” In this context, he refers to the type 1 endoleaks that may occur at the anchoring point of the stent graft. Here, immediate correction is required by either inserting a second stent above the first, or by performing a balloon dilatation. “When contrast agent leaks out of the operat-

"Cios Alpha has resulted in enormous strides for the imaging process."

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ing site, then I have to ascertain where it's coming from straight away. Is the stent graft or a lumbar artery leaking, or is it really a technical matter of a missing seal which I can and must rectify without delay? The imaging must be able to help me identify the problem," stresses Lang.

Earlier C-arm models did not always permit the reliable positioning of aortic stent grafts. But, as the vascular surgeon reports, Cios Alpha has resulted in enormous strides for the imaging process. The increased image quality is particularly evident when it comes to obese patients. As the latest endovascular procedures also permit treatment of the renal arteries, the requirements are now changing, as Lang explains: "If we consider that a renal artery measures perhaps 5 millimeters in diameter and the patient weighs 120 kilograms, then we are entering the area where the device's performance capacity is put to the test." And with its high resolution and 25-kilowatt generator, Cios Alpha offers the necessary power. However, the physician is also concerned with the peripheral arteries in the lower leg and feet: "We frequently treat patients where arteries are no longer discernible in the forefoot area and where the blood circulation is discontinued." This information, which allows surgeons to estimate the duration of the wound healing process, must be provided by the imaging device.

The experiences with Cios Alpha in Erlangen have resulted in a marked improvement in image quality, even in the case of thoracic procedures. As respiratory and cardiac movements must be taken into account here, a rapid image sequence is essential. In the flat detector, the image information contained within each pixel is read out up to 30 times per second.

Working with the Mobile C-Arm

Surgeons particularly appreciate the fact that they can enter many of the required settings manually at the operating table. They understandably wish to control the entire procedure without having to rely on third parties. The Erlangen-based physicians' experience of Cios Alpha's high level of controllability was thoroughly positive, and they noted that the remote user interface touch screen located directly in the sterile area of the operating table was particularly useful. It improves workflows and also has benefits for patient safety, explains Lang: "When I need to

The city of Erlangen has a focus on healthcare with the University Hospital in its center.

Werner Lang, MD FEBVS, Professor of Surgery

Professor Lang heads the Department of Vascular Surgery at the University Hospital in Erlangen since 1995, and performed initial intraoperative angiographies as early as 1992. His research focus is arterial occlusive diseases. He is particularly interested in combined interventions in which the wounds of diabetic patients are covered in a dual collaboration with plastic surgeons, primarily because one of the department's key areas of activity lies in the treatment of peripheral arterial occlusive diseases, with difficult cases increasing in parallel with the rising number of diabetics. A total of 1,200 operative procedures are performed at the vascular surgery department in Erlangen each year. One fifth of these patients undergo endovascular surgery. In Lang's opinion, there is a marked focus on healthcare in the city of Erlangen, which boasts an excellent interplay of clinic, research, and industry partners.

catheterize an artery and the attempt is only unsuccessful because the image settings are incorrect, then the patient is the one who suffers. I can now alter the settings directly on the C-arm and thus visualize and solve the problem more effectively." A further advantage is that the surgeon can now also adjust the position of the C-arm quickly and easily via the touch-sensitive electromagnetic brake controls mounted directly on the flat detector housing as the situation requires. In addition, specific C-arm projections can be saved via the single-touch positioning function and recalled at a later stage of the procedure at the touch of a button – all thanks to the integrated motorization. The only prerequisite here is that the position of the entire C-arm system at the operating table remains unchanged.

Lang and his colleagues also welcomed two other features with open arms, namely the integrated laser marking and angle-of-rotation indicator. The laser light, integrated in the flat detector housing, marks the central position within the operating area, ascertaining that, after the pivoting of the C-arm, the image center remains in the middle of the leg, for example. The user-friendly angle-of-rotation indicator also supports the C-arm's precise positioning. And if artery exits or the exact positions for stent grafts need to be defined in the X-ray image, the live graphical overlay function is used. Structures in the on-screen image are marked with white lines via the touch screen, thus enabling the surgeons to orient themselves safely and securely during the catheter's insertion in fluoroscopy mode as the intervention progresses, without resorting to the additional use of contrast agents.

The Package Fits the Bill

Cios Alpha was tested in Erlangen for six weeks, with two to three procedures performed each day. These interventions were typical of the department's day-to-day work and included all types of arterial reconstruction, carotid and aneurysm surgery, and combined interventions with bypasses and dilatation. Professor

Lang's verdict is clear: "Although our expectations were naturally very high, they were all fulfilled. We discovered that the device is extremely well prepared for a diverse range of requirements. The important thing is that the package is correct. I think it's fair to say that Cios Alpha is a multitalent."

Matthias Manych, a biologist, is a freelance scientific journalist, editor, and author specializing in medicine. His work appears primarily in specialized journals, but also in newspapers and online.

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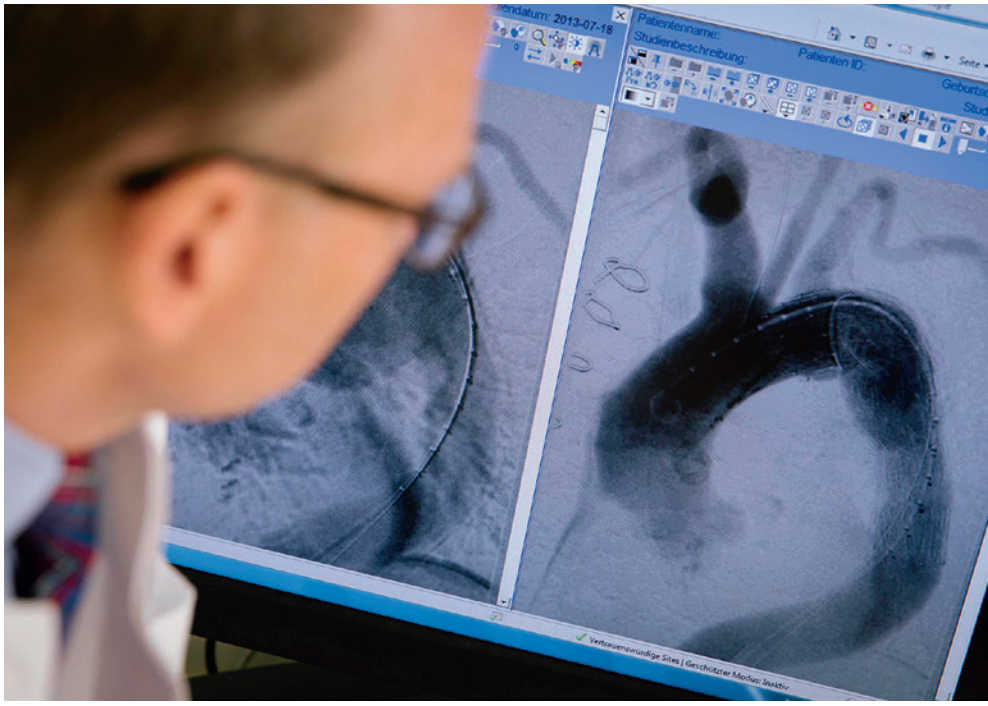

Professor Lang is impressed by the precise image quality of Cios Alpha.

Patient Safety

Professor Lang, what are the consequences of working with Cios Alpha?
Lang: Devices like Cios Alpha certainly facilitate a relaxed working style. Lighting conditions in the operating room can vary considerably, so if I have an optimal image on the monitor despite these fluctuations, I can relax into the work completely. However, if I am forced to squint to see everything clearly, then my eyes are bound to grow tired when I operate, particularly during long procedures. Although surgeons are used to maintaining their concentration levels over long periods, I find it important to acknowledge that making working conditions easier helps to increase patient safety, because the error rate is reduced.

Have you experienced improvements with Cios Alpha in other areas?
Lang: Imaging of this type and quality was not available previously. The intraoperative control we currently enjoy has taught us that not everything visible is relevant. This takes some getting used to, as the results have to be evaluated straight away, but not everything requires correction. Surgeons become far more technically precise, as everything they do is visible in detail immediately. This is an excellent learning process and good for the patients too.

To provide an example of a follow-up check: During an intraoperative check on a patient, we notice that the middle section of the vein is relatively thin. Although we can leave this for the present, we'd like him to attend a check-up in eight weeks' time. As a result, this imaging technology also has an effect on postoperative care.

Intraoperative imaging also has benefits for bypass surgery, for example. Gaining information about the outflow during the surgery, which is now possible, is of enormous importance. Today, we can potentially recognize a constriction in the periphery during the surgery, which was not visible during preoperative imaging. I subsequently have to decide whether to treat this immediately via dilatation or in two stages. This makes the discipline more challenging, but simultaneously more interesting.

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