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

Dr. med. Bruno Podesser, Associate Professor of Surgery,
Landeskrankenhaus St. Poelten, Austria

Answers for life.

On the Beating Heart – Intraoperative Imaging with the Mobile C-Arm Cios Alpha

Moments in which patients' lives hang by a thread require maximum concentration from heart surgeons and their teams. For Dr. Bruno Podesser, Associate Professor of Surgery and Senior Consultant in the Cardiac Surgery Department at the Landesklinikum St. Poelten, Austria, outstanding X-ray images and stable power are decisive safety factors. As far as the mobile C-arm Cios Alpha is concerned, he's convinced that "we now have the device which meets our needs."

Text: Matthias Manych Photos: Sven Doering

Dr. Bruno Podesser is specialized in the reconstruction and replacement of the mitral and aortic heart valves.





Longer life spans and higher quality of life: Bruno Podesser is happy with the advances in cardiac surgery.

“With Cios Alpha I can now recognize all the significant structures.”

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Cardiac Surgery Department,
Landeskrankenhaus St. Poelten,
Austria

One factor which has a significant impact on work in the operating room is encountered by Dr. Bruno Podesser on a daily basis – demographic change. On average, patients in his department are eight to ten years older than they were 20 years back. Says Podesser: “The mean age for patients undergoing coronary interventions is 68 years, rising to 72 years in the case of cardiac valve surgery.” And these figures carry some weight, as, with 1,000 heart operations annually, the Cardiac Surgery Department at the Landeskrankenhaus St. Poelten is one of the three largest in Austria. Around 50 percent of patients treated here require surgery on the coronary arteries, while 40 percent are admitted for heart valve replacements and the final 10 percent receive aortic surgery with simultaneous heart valve replacement. The old, frequently frail patients, many of whom are afflicted with countless other comorbidities, benefit greatly from the miniaturization and increasing reduction in operative trauma facilitated by minimally invasive techniques.

More Intervention Options ...

Today, Bruno Podesser is happy to be able to offer more and more patients treatment options which result in both longer lives and a higher quality of life. As an example, he cites patients who “return to us years after a stent graft implantation with three-vessel disease and can still receive bypass surgery”. Further examples include successes with stent grafts in the aorta and the pleasing long-term results experienced with biological aortic valve prostheses. However, many advances in the interest of improved patient care outside of hybrid operating rooms are only possible with the image quality and the technical capacity offered by state-of-the-art mobile C-arm systems. In this context, the cardiac surgeon thinks of meticulous tasks such as the transcatheter aortic valve implantation (TAVI), where it is

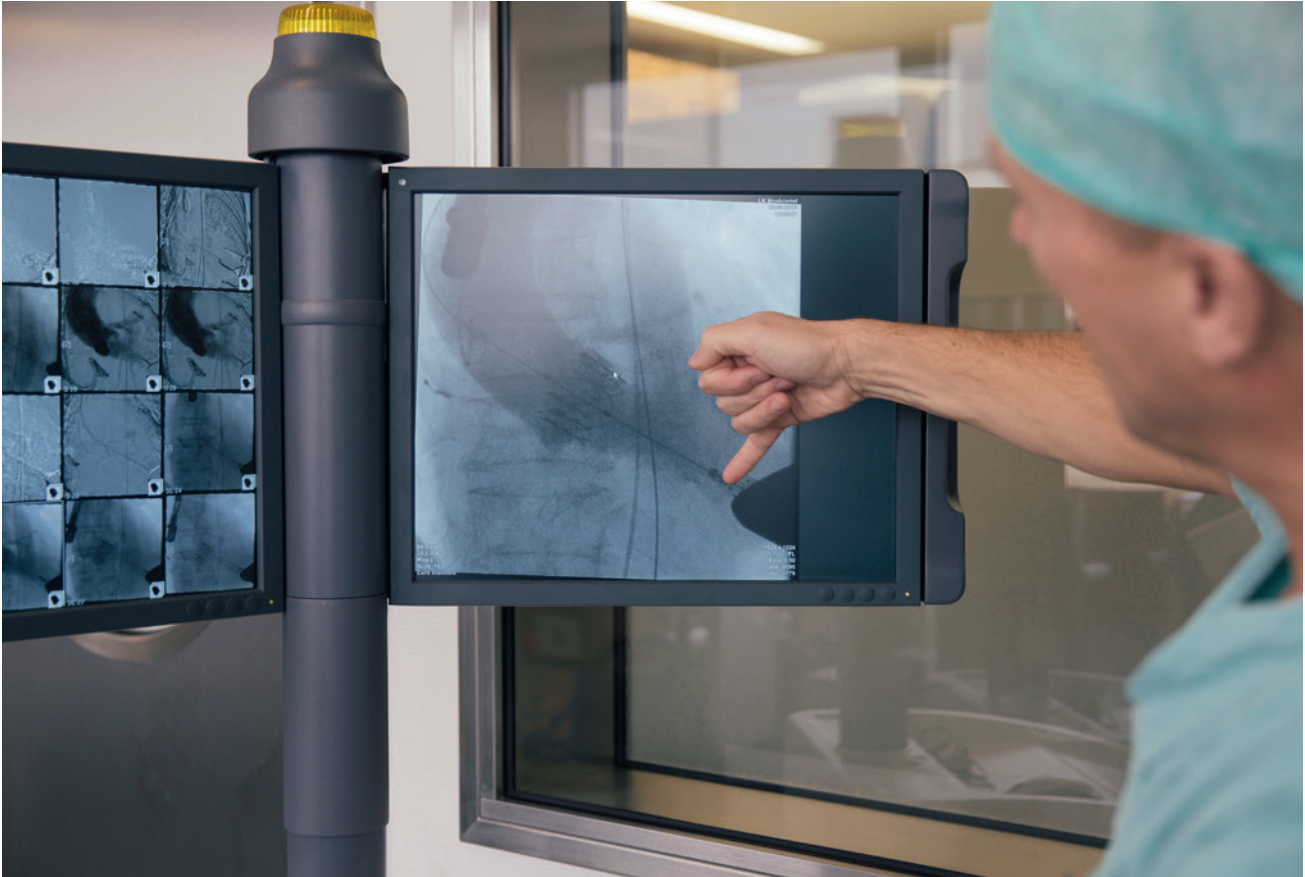
essential to position the aortic valve precisely at the level of the body’s own valve. “If I am too high, I run the risk of covering the coronary artery exit. If, on the other hand, I am too low, the valve retreats into the ventricle, into the outflow tract, and I am left with a serious complication that can result in the death of the patient,” explains Dr. Podesser. In his view, the spectrum of applications of mobile C-arms like Cios Alpha ranges from the implantation of cardiac pacemakers to transapical and transfemoral TAVIs, carotid angiographies, and the entire stent technology for the major vessels.

... and Improved Quality Checks with Cios Alpha

Intraoperative quality checks have become a matter of course. When performing a TAVI, the cardiac specialists in St. Poelten attach the utmost importance to documenting each step via imaging technology – the valve positioning and balloon dilatation as well as the final angiography. Intraoperative angiography is also used as a standard checking procedure for carotid surgery. Cios Alpha can now be used for this purpose too. The new flat detector is not only equipped with 1.5 k by 1.5 k resolution, but also boasts a field of view of 30 times 30 centimeters, which is 25 percent larger than conventional image intensifiers. All decisive structures are now displayed, distortion-free, across the detector’s entire surface area.

The high resolution is always of particular importance if an intervention on the coronary arteries might be required. It follows that, during a transapical heart valve replacement, calcium deposits on the original valve, which were pressed into the vascular wall by the balloon catheter, displace a coronary artery exit. In this instance, stent treatment during the same intervention is imperative. “And there’s no question that the improved resolution offered by Cios Alpha is indispensable here,” emphasizes Dr. Podesser. Cios Alpha’s rapid image sequence also makes it ideal for

Intraoperative Imaging in Cardiac Surgery



Precise transcatheter aortic valve implantation (TAVI) with Cios Alpha.

Dr. Podesser, what has changed during the course of your career?

Podesser: It's virtually impossible to equate the situation 20 years ago with working conditions today. Back then, intraoperative imaging was comparable to wandering around in the fog or in a snowstorm. That's why we were so happy with the introduction of metal cores for the pacing wires, as it was the only way to definitely see where we were on the X-ray image. It was extremely difficult to define the boundary between atrium and ventricle, for example. The mobile C-arm Cios Alpha makes this task so much easier.

How does the imaging quality provided by Cios Alpha influence your work?

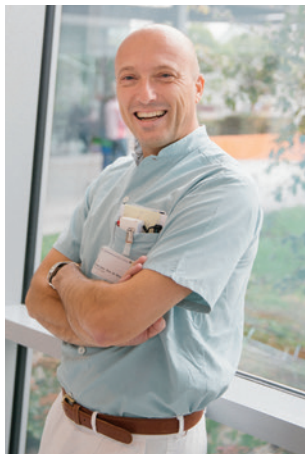
Podesser: We're required to concentrate on the surgical aspects. I can now recognize all the significant

structures and actually have the luxury of being able to concentrate all my attention on the current operation. Minimally invasive surgery naturally requires us to abandon the safe ground under our feet. And a new aspect of intraoperative imaging is perhaps that it now gives us back this lost security via the sheer sophistication of the images produced. Working with Cios Alpha will probably also reduce the operating times. And, above all, patients suffer less, which is the most important thing.

What is your overall assessment of the mobile X-ray system Cios Alpha?

Podesser: The excellence of this device permits interventions during each and every instance of cardiac surgery. We can't ask for anything more right now.

Dr. med. Bruno Podesser, Associate Professor of Surgery



Bruno Podesser has been involved in cardiovascular research since his student days. Twenty years ago, he founded the Vienna Working Heart Research Group at the Medical University of Vienna (MUW), a lab for young scientists devoted to pure research. The term “working heart” refers to work on an isolated heart simulation. Dr. Podesser learned about this technique in the USA in 1991, and introduced it to Vienna. He has been a board member of the Ludwig-Boltzmann-Cluster for Cardiovascular Research since 2006. His research priorities include the

long-term results of biological heart valve replacements and intraoperative heart protection during cardiac surgery. The heart surgeon has been working at the Landeskrankenhaus St. Poelten since 1998. There, his main clinical interests center on the reconstruction and replacement of heart valves, more specifically both the mitral and aortic valves.

use in so-called “beating-heart” surgery. The image information contained within each pixel is read out up to 30 times per second.

Cios Alpha is also equipped with a 25-kilowatt generator with a patented, active cooling system. The strength of the X-ray tube provides optimal precision. This is especially important in the imaging of highly obese patients. And the cooling system provides continuous generator power, even during long procedures – a crucial safety aspect for Bruno Podesser. Older C-arms used to switch themselves off relatively quickly, after around ten minutes’ exposure time, as a measure to protect against overheating. It was impossible to perform TAVI interven-

tions, among other treatments, using the earlier generation of mobile C-arm systems, as, according to Podesser, the C-arm should not show any weakness when the new aortic valve is positioned. “We no longer have this problem with Cios Alpha. In these moments, the patient’s life is briefly hanging by a thread. If I experienced a technical disruption at this juncture, it would be a catastrophe,” explains the heart surgeon.

Simple Operability, Improved Workflow, Increased Safety

During tests with Cios Alpha for TAVI operations in St. Poelten, Dr. Podesser and his team found the workflow with the mobile C-arm system far more fluid than was the case with previous models. The large field of view permits the entire thorax to be displayed in a single image. As a result, it is no longer necessary to reposition the C-arm for further images, which simultaneously saves on contrast agents. However, if the C-arm does require repositioning, the surgeon can do this quickly and easily on the flat detector housing at the touch of a button. Bruno Podesser also sets great store by motorization. This now allows specific C-arm projections to be saved with the aperture setting and recalled precisely and quickly at a later stage of the procedure at the flick of a switch.

The heart surgeon is very impressed with the slim-line monitor cart’s mobile flat screens – very handy in the narrow confines of the operating room – and, above all, the touch screen’s user interface. “The logical structure, which shows the radiological key data on the left, then the patient section, and finally the area to which the actual image refers, makes for highly intuitive operation,” explains a clearly delighted Bruno Podesser. Thanks to Cios Alpha, the level of precision and the likelihood of achieving the desired results with an implantation are further boosted by the live graphical overlay. This function permits the valvular level to be marked on the X-ray image during a heart valve

replacement, for example, in order to align the position of the implanted valve as precisely as possible. Dr. Podesser is convinced that “the live graphical overlay function has the potential to become a routine instrument of great significance.”

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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“I can now recognize all the significant structures and actually have the luxury of being able to concentrate all my attention on the current operation,” says Dr. Podesser.

Case Study: Aortic Valve Replacement Due to High-Grade Stenosis Intervention: Transapical TAVI with the Mobile C-Arm Cios Alpha

Condition: Acquired aortic valve stenoses can be triggered by inflammatory processes, natural deterioration or calcium deposits. The case in question involved a valve stenosis in the vicinity of the left flow path of the aorta, which resulted in the left side of the heart pumping against an elevated resistance. The aortic valve stenosis is the most frequent cardiac valve disease in Western countries, and occurs increasingly with age. Around 4 percent of patients over the age of 75 are affected.

Patient: Several years ago, the 83-year-old female patient received two coronary stents and a pacemaker implantation as a result of two-vessel disease. The patient was also suffering from increased airway resistance. Condition pre-op: high-grade calcified aortic valve with severe respiratory difficulties.

Therapy decision: The comorbidities, overall weak condition and high-grade aortic valve stenosis with high postoperative stroke risk resulted in the decision to give the patient a transapical TAVI.

Intraoperative challenges: Precise positioning of the replacement valve with complete displacement of the original aortic valve on a high-risk patient. The requirements of the imaging system consisted of an extremely high resolution with rapid image sequencing and continuous generator output. Subtraction angiography was used to display the coronary artery exits, among other areas, and it supported the drawing of the live graphical overlay. This function is an important orientation tool for the most critical moment of the TAVI intervention: ultraprecise positioning of the replacement valve to allow long-term stability.

Outcome: The verification images produced at the end of the procedure showed that the replacement valve was located in the scheduled position and was opening normally. The supply of oxygen required by the patient was restored successfully, and she was discharged after seven days in hospital.

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