

# The Multidisciplinary Hybrid OR

By Wiebke Kathmann, PhD

**In 2012 orthopedic trauma, cardiovascular, and neuro surgeons embarked on a common journey at the Ulm University Hospital in Germany – the multidisciplinary use of an Artis zeego hybrid room. AXIOM Innovations met the team to talk about their visions, experiences, and lessons learned during the first year.**

It all started when a new University Hospital building was built in Ulm in 2012: a center of maximum care with over 1,100 beds and over 5,000 employees. This was Prof. Dr. Florian Gebhard's fortuitous moment. As the Director of Orthopedic Traumatology, Hand, Plastic, and Reconstructive Surgery, he seized the opportunity and realized his dream of setting up a 3D-robotic-imaging system integrated with navigation technology. His vision was to confirm that the combination of systems works for neurosurgery and orthopedic trauma, especially complex trauma interventions of the spine and pelvis.

Due to fiscal and room utilization constraints he invited the neurosur-

geons, vascular, and heart surgeons on board early in the discussions and as a result the hybrid room was optimized for all specialties.

## Planning the Hybrid OR

When setting-up a hybrid room, taking time for the details of the layout is important, reports Peter Richter, MD, Prof. Gebhard's right hand man. This is especially true if it is to be used by several disciplines. In Ulm the starting point was a 65 square meter traditional OR with the Artis zeego robotic imaging system as the centerpiece. "In our case this flexible floor-mounted system with 3D functionality and Automap gave us the versatility necessary for multidisciplinary utilization," stated Dr. Richter. "As for the navigation system, our choice was the Brainlab Curve™. Choosing the other components of the OR, like a laminar air flow, modern OR-table technology as well as large flat detectors for wide patient coverage took quite a while," recalled Dr. Richter. Since it had to be ensured that patient positioning, for example, had to meet everyone's demands regarding workflow, unrestricted access to the patient while also providing substantial space for anesthesia and the additional equipment for other specialties.

## Communication and Sharing are Key

Looking back on their first year, all teams regard communication as key. They advise others who want to embark on the journey of a shared hybrid OR to plan on regular meetings from the beginning. "Clearly, a jour fixe is of great help, ideally with a coordinator taking care of the common needs of all disciplines involved," said Prof. Rainer Wirtz, MD, Director of the Clinic for Neurosurgery in Ulm and Günzburg. "That way you can discuss upcoming issues and share experiences – for instance regarding patient draping, data storage, or simple things like anesthetic equipment positioning during 3D acquisition."

Besides the jour fixe recommendation, predefined rules and a clear schedule for all disciplines involved was considered important by all groups. In Ulm the hybrid room is reserved by the orthopedic trauma surgeons two days a week, the vascular/cardiac surgeons another two days, and the neurosurgeons one day a week. Extra hours originally allocated to other teams could be booked through the coordinator in order to maximally utilize the hybrid lab. Currently, the hybrid room operates weekdays from eight a.m. until six p.m.



*“The basic settings and principles all worked as desired from day one.”*

**Prof.  
Florian Gebhard, MD**

Director of Orthopedic  
Traumatology, Hand, Plastic,  
and Reconstructive Surgery

Another lesson learned in Ulm was that having dedicated OR staff, working with the Artis zeego every day of the week, ensures the success of the hybrid OR. Dr. Wirtz recommends having either a technician or a nurse responsible for the room and the management of the different systems. Problems that come up at the end of the day can be forgotten or ignored so that the next team inherits them – unless person responsible for the room can act as a technical liaison. Dr. Wirtz also suggests that the person in charge of the hybrid OR be complemented by another person responsible for the technical needs of each specialty, such as post-processing, troubleshooting, system movements, or positioning.

#### **The Importance of Proper Training**

Proper training is another key issue. With the additional benefit of team building in mind, Dr. Wirtz recommends for surgeons and technicians of all disciplines to participate in a common basic training unit on the system. This should be followed by a specialized training session for each discipline. “Once going live, starting with easy cases helps to optimize workflow,” Dr. Wirtz explained. “Before attempting highly complicated cases, wait a couple of months

until you feel comfortable with the movements of the Artis zeego, the nurses know where to stand, and the anesthesiologist identifies where to place their equipment,” added Dr. Richter. Everyone agrees that only fully trained staff should be allowed to work with the system. Even though each of the Ulm hybrid room teams only had a maximum of two days a week the basics of the system were learned very quickly. “This is in part due to the very intuitive handling of the Artis zeego,” stated Prof. Robert Bauernschmitt, MD, Director of Clinical Research for Cardiac Surgery sharing the hybrid OR. “Anyone experienced with Siemens’ C-arm systems will have an easy time getting up to speed.”

#### **Proof of Principle**

At Ulm the set-up of a multidisciplinary hybrid room has worked out well. Most expectations were met, and new clinical applications became possible. “The basic settings and principles all worked as desired from day one. New ideas that developed along the way, like programming different starting positions for the navigation in relation to the table, are now implemented,” said Prof. Gebhard. “We have a very good platform after one year to develop new or improve

# Artis zeego Features Used Regularly in Ulm

Application	Scope of Application	Additional Remarks
<b>syngo DynaCT</b>	3D imaging for vessels or soft tissue.	Variable dose levels and rotation times determine quality of contrast resolution.
<b>syngo DynaCT Large Volume</b>	The unique movements of the Artis zeego allow a volume of 35x25 cm to be acquired.	Useful for pelvic trauma, EVAR and spine surgery cases.
<b>syngo InSpace 3D/3D Fusion</b>	After a low dose 3D spin of a contiguous bony structure, <i>syngo InSpace 3D/3D Fusion</i> allows a 3D volume from MRI, CT or PET to be used for navigation intraoperatively.	Can be used alongside or instead of <i>syngo DynaCT</i> .
<b>syngo DynaPBV Neuro</b>	A subtracted 3D acquisition which demonstrates tissue perfusion.	Currently used in Ulm for neuro surgery but also available as <i>syngo DynaPBV Body</i> for abdominal imaging.
<b>syngo iGuide</b>	Needle guidance software.	Useful for K-wire/screw placement during spine surgery.
<b>syngo iPilot Dynamic</b>	Allows the superimposition of a 3D volume onto 2D fluoro regardless of system geometry (table position, zoom, C-arm angulation).	Used in conjunction with <i>syngo DynaCT</i> or <i>syngo InSpace 3D/3D Fusion</i> .
<b>syngo iFlow</b>	One click turns a standard 2D angio run into a time-colored blood map.	The ROI function is useful to quantitate flow diverter effectiveness, post embolization tissue perfusion and post vascular intervention flow.
<b>CAREposition</b>	Radiation free C-arm or table repositioning.	Saves dose by reducing the amount of radiation on-time.
<b>Overlay Ref</b>	The contrast and dose reduced version of traditional roadmap.	Often used in conjunction with Automap.
<b>Roadmap</b>	Standard interventional neuro tool.	Advanced Roadmap allows for windowing of mask image during intervention.
<b>Automap</b>	Enables the Artis zeego to move quickly, automatically and exactly to any number of predefined views.	Especially useful in spine surgery.
<b>Quick positions</b>	Three quick-store and quick-retrieve buttons at tableside.	Often used in cases where two or three different imaging positions are repeatedly required.

existing workflows, like the use of *syngo* iGuide in trauma, reducing radiation exposure for everyone on the team. Hopefully we can prove that 3D imaging combined with navigation can reasonably reduce radiation dose to one twentieth of what it used to be."

The biggest success for Prof. Gebhard is the proof of principle for combining the imaging and navigation systems in orthopedic trauma surgery. "We were the first to prove that it works," stated Prof. Gebhard. Up until now images gained outside the OR could not be used intraoperatively for navigation purposes. An example is for tumor resections. Now, they can even be generated in the OR itself. "Being able to perform image fusion in the OR, or using intraoperative *syngo* DynaCT saves considerable planning and preparation time, and helps with adhering to preoperatively defined resection margins," explained Dr. Richter.

Prof. Gebhard and his team use the hybrid room for complex spinal and pelvic fractures, especially for navigated stabilization of the spine and for oncologic bone surgery. The Artis zeego provides them with more confidence due to the higher image quality, larger field of view, and greater heat loading than older style image intensifier imaging. "There is a huge benefit for minimally displaced fractures of the pelvis, for the obese, and for elderly patients," concluded Prof. Gebhard.

### Neurosurgical Frontiers

As for the neurosurgeons the new angio-based hybrid lab also opened up new prospects, even though Dr. Wirtz already had long-standing experience with intraoperative imaging in neurosurgery when he came to Ulm five years ago. He is one of the pioneers of intraoperative MRI in neurosurgery. "While I was at Heidelberg University we were the first department worldwide to use intraoperative MRI in a brain tumor resection." With an MRI-based hybrid OR in Günzburg and more than 600 cases with MRI by now, Dr. Wirtz and Ralph König, MD, Assistant Director of Neurosurgery in Ulm, were interested in an angio-based hybrid room for aneurysm cases, above all. "Aneurysm clips

create artifacts in MR imaging, which in turn makes it difficult to evaluate the patency of the vessel," stated Dr. König. "Plus, one feels more secure in using angio during sophisticated neurovascular interventions needing branched and fenestrated stent grafting. Lastly, it is very useful to have high quality intraoperative soft tissue imaging after microsurgical excision of an AVM, in order to detect residues, which would increase the patients' risk of hemorrhage."

One new area of interest for the neurosurgeons is 3D imaging with an intravenous contrast injection. A ten second *syngo* DynaCT spin with 80 cc of full strength contrast and viewing with 15 mm MIP slices is the current technique.

### Special Needs in Cardiovascular Cases

For Dr. Bauernschmitt, who only joined the common journey this April, the situation is a little different from his neurovascular and orthopedic counterparts. He brings more than ten years of experience in hybrid OR from his time as Deputy Director at the German Heart Center, Munich. His expertise is in innovative catheter heart valve procedures like TAVI and mitral valve repair. He and Prof. Andreas Liebold, MD, Director of Cardiovascular and Thoracic Surgery, see the hybrid OR in their field as a must-have. Prof. Liebold, who became the Director of this Department in 2011 and was Deputy Director at the University of Rostock, is now responsible for the hybrid OR. The team of cardiac surgeons brings the most experience to this OR.

As the cardiac surgeon in the Ulm multidisciplinary hybrid room, his challenge comes from the motion of the organ he deals with. "Cardiac and vascular surgeons work on soft tissues with inherent organ movement, as opposed to relatively fixed structures in trauma and neurosurgery. One could say that repairing a structure like an aortic valve is like tying a shoelace while running. Therefore, we have slightly different needs in the hybrid OR." When asked about software, Dr. Bauernschmitt's opinion is that *syngo* Aortic ValveGuide

would be of great benefit to sites training in aortic valve implantation and for the new generations of anatomical valves. He is most interested in impending technical imaging advances for mitral valve repair.

### Future Perspectives

If asked about the future, the physicians agree that they can see a time when expansion would be desirable and all would choose to construct a multidisciplinary hybrid lab again. Dr. Bauernschmitt's recommendation would be that "disciplines working with soft tissue like cardiac surgeons and abdominal surgeons would share one OR, while the other OR could be shared by orthopedic surgeons and neurosurgeons working on or around bones." For now, the Ulm hybrid room team will expand by training more staff and extending the hybrid room hours.

### Read more about multidisciplinary use of a hybrid room in following chapters.

Medical writer Dr. Wiebke Kathmann is a frequent contributor to medical magazines for physicians of German-speaking media. She holds a MA in Biology and a PhD in Theoretical Medicine and worked as an editor for many years before going freelance in 1999. She is based in Munich and Karlsruhe, Germany.

### Contact

penelope.vos@siemens.com