

10 Years of Hybrid Operating Rooms in Germany: Lessons Learned

At the beginning there was a vision: sparing patients from open surgery and saving hospital administrators from having to have a huge intensive care unit. With the dawn of endovascular procedures it became clear to Professor Giovanni Torsello, M.D., of Münster in Germany, that hybrid rooms would be the future.

By Wiebke Kathmann, PhD

When Torsello got started ten years ago he was one of the pioneers in the field and the first to build a hybrid room in Germany – in his case a relatively small investment and a big success. Asked about how he, being a vascular surgeon, came to set up a hybrid room, Professor Giovanni Torsello, M.D., Chief Physician at the St. Franziskus Hospital in Münster and Director of the Center of Vascular and Endovascular Surgery at the University of Münster, Germany, explains: “We noticed that many elderly, weak, and high risk patients had difficulties recovering after vascular operations. We wanted to solve the problem

without harming the patient. Minimally invasive procedures, with the option to continue as open surgery if needed, seemed to be the answer.”

With this vision in mind, Torsello seized his chance to set up a hybrid room when hearing about a new, vacant, and spacious operating room at the St. Franziskus Hospital in 2002. The situation was ideal as it already was an operating room with the sterile environment needed, with sluices, changing rooms for men and women, and – another big pro – in a central location. “It wasn’t an isolated application which saved us a lot of money,” recalls Torsello. He and his





team introduced an excellent imaging system into the sterile environment – the high-quality AXIOM Artis C-arm angiography system – and got started. Soon after the administration realized that there was a big demand. Patients came from all over Germany and neighboring countries to be treated by Torsello and his team. But not only patients, physicians in training and senior physicians also cued up to learn and practice this approach, a situation satisfying not only to Torsello but the administration as well.

Serving the Patient Better

The demand for hybrid interventions and hybrid rooms is tremendous and will continue to grow as age as well as obesity and diabetes take more of a toll on the vascular system. More and more complex lesions and lesions in locations that are difficult to reach by catheter or stent need to be treated. Due to the incredible developments in vascular therapy over the past decades the goal of today is

to keep interventions as minor as possible. Especially in aorto-iliac occlusive disease, emergency interventions, and thoracic or aorto-iliac aneurysms, endovascular interventions increased tremendously between 2000 and 2010, sparing patients the opening of abdomen or thorax.

All these interventions strongly depend on high quality digital subtraction angiography (DSA) systems in the operating room – not just for treating small lesions but to better serve the patient, as Torsello points out. At the St. Franziskus Hospital almost all patients with aneurysms are treated endovascularly now, more than 300 per year. It has become the therapy of choice. “Compared to open surgery we have reduced in-hospital mortality, complication rate, median length of stay, and cost,” says Torsello.

Central or Isolated Location?

As a pioneer Torsello has provided many colleagues with advice and only recently set up the second-generation hybrid

room in his hospital, which will soon be followed by a third hybrid room at the Center of Vascular and Endovascular Surgery at the university – one of the biggest and most innovative centers of vascular intervention in Europe.

From his experience with his first hybrid room Torsello favors a centrally located hybrid room. His recommendation: “If you have the opportunity to connect the hybrid room to a central operating tract, do so. That way you do not need to deal with construction issues and sluices – which saves money.”

His new hybrid room at the hospital was built as an isolated application starting from a radiology space, which brought about challenges regarding workflow and storage of equipment causing the architect quite a headache.

Hybrid operating rooms are preferably installed in an existing surgical wing to minimize reconstruction and to reduce costs



Artis zee floor in the head-end position during the intervention.



Consider Workflow

In Torsello's eyes, workflow is an extremely important aspect in designing a hybrid room. If the room is used by multiple disciplines, storage is an extremely challenging issue. Not all the materials can be kept in the common space. Therefore, all teams using the hybrid room need to enter with a little cart holding their special prostheses. Whenever a special catheter is needed during an intervention, the material needs to be fetched from quite far, with the hopper having to change from sterile to non-sterile and back. That complicates matters.

Workflow is an important issue to consider when setting up a hybrid room.

Regarding the setup of the hybrid room itself there was very little change from the first to the second of Torsello's hybrid rooms. The basic layout, concept, and angio system have stayed the same, even though the second-generation hybrid room is a multidisciplinary one.

High Quality Imaging a Must

The big step of the past ten years was to bring excellent imaging into the sterile setting. This brought about qualitative improvements in regard to more complex interventions, research options, patient volume, performance, and patient satisfaction. Therefore, choosing the right angio system is key. Experience shows that medical engineering companies should be included early on in the planning process as hybrid rooms are extremely complex working environments, with the angio system being the centerpiece and all other equipment revolving around it. Torsello's first-generation hybrid room was equipped with an AXIOM Artis. "We very much valued the overlay function that is the option to steplessly change between the native image and the summed-up image. It made all the difference for therapy." Other important features for him are pulsed fluoroscopy to reduce dose for patient and staff, some preprogrammed working positions to simplify workflow, and, mainly

for aneurysm interventions, an automap function, which spares the patient extra angiograms and therefore contrast agent. Fluoroscopy time is another important issue. Most C-arms do not fulfill the requirements for long continuous or pulsed fluoroscopy over several hours and need to be given time to cool down – a catastrophe for the patient.

If hybrid interventions play a prominent role or the hybrid room is shared with a cardiac surgeon, even more sophisticated solutions like the Artis zeego are needed.

Key to success is bringing excellent imaging to the sterile OR environment.

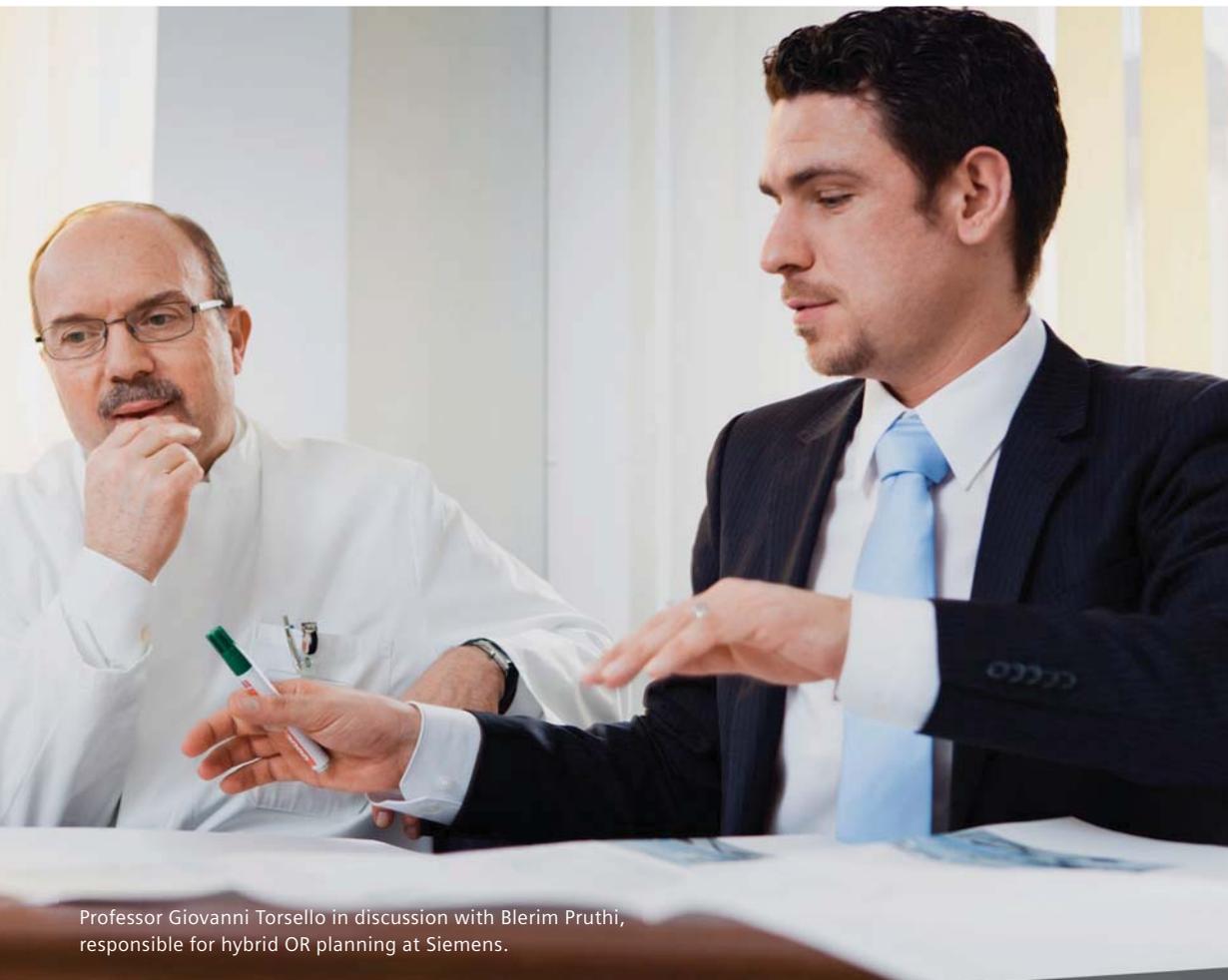
Autonomy a Key Issue

Handling is another key issue when performing angiography in the OR. Using a regular C-arm necessitates the help of other people to support the examiner. Therefore, a precise language to communicate about directions is needed. With employees changing jobs a lot



Artis zee floor in the park position while patient is prepared for the intervention.





Professor Giovanni Torsello in discussion with Blerim Pruthi, responsible for hybrid OR planning at Siemens.



this information is hard to convey with the required precision. Surgeons might lose their nerve in complex interventions. Therefore, Torsello favors a set-up where the examiner navigates the table himself.

The surgeon needs to navigate the table himself.

Size Matters

This is not only true for the hybrid room itself but the table, too. A hybrid room should have a minimum size of 50 square meters (540 square feet), suggests Torsello. If hybrid interventions play a prominent role or the hybrid room is shared with a cardiac surgeon, as will be the case in his third hybrid room at the university, an even bigger room is needed for the team to move

about without the risk of becoming non-sterile or hurting someone with the C-arm. From his experience Torsello recommends not to have any closets in the room.

Space is extremely important. 50 m² are the minimum, 70 m² if it is a multidisciplinary hybrid room.

From his ten years of experience Torsello recommends a free-floating table that can be tilted from all positions and has a rack for auxiliary equipment. For ergonomic reasons it shouldn't be too wide. "As long as one works with a catheter the width is not that important. But when working bent down for hours to reach the middle line of the patient the body position will lead to problems unless the table is narrow."

Choose a narrow table that can be tilted.

Laminar Airflow a Necessity?

The participation of a hygienist and medical engineer in setting up a hybrid room is of utmost importance. Both can give valuable input as to whether a floor- or ceiling-mounted angio system is preferred – issues that must be decided at an early stage. "Combining a ceiling mounted C-arm and a laminar air flow (LAF) ceiling is very complex and expensive. The efficacy of the LAF is reduced when the ceiling-mounted C-arm is in working position. Therefore, we recommend floor-mounted C-arm systems which can be installed even under existing LAF ceilings," says Blerim Pruthi, the responsible planner for



hybrid rooms at Siemens, the dominant player in the market.

Whether laminar airflow is needed largely depends on national regulations and the interventions performed. At the St. Franziskus Hospital the team has successfully worked without it for the past ten years.

Involve hygienist and medical engineers early on.

Investment confidence

The fear of administrators ending up with an empty hybrid room can easily be dissipated. Between September 2003 and December 2011 Torsello's team performed 8,651 interventions in their hybrid room, 5,671 of them endovascular interventions and angiographies, 1,975 combined interventions, and

1,005 conventional operations. If the 300 aneurysm treatments he does per year alone were performed as open surgery, the size of the intensive care unit would have to be increased by another 30 beds – an impressive argument for administrators.

Besides, a hybrid room is very helpful in conventional operations as it permits one to check the restoration of blood flow. In the long run this leads to fewer revision operations.

10 years from now

Ten years after getting started Torsello is more convinced than ever that the future lies in endovascular procedures and hybrid rooms. "For those 10 to 20 percent of patients in whom the anatomical situation is not suited for endovascular treatments, we will still

need vascular surgeons trained in conventional operations. But we no longer need pure operating rooms – they can perform the intervention in the hybrid room." Hybrid interventions will become the standard operation of the future. The evolution is not over yet. Fenestrated endografts for aneurysms involving visceral arteries are one of the new frontiers.

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