



# Advancing vascular surgery

## Hybrid OR facilitates complex interventions

### Who/where

- Dr. Björn Holmgren, Kalmar County Hospital, Sweden
- Dr. Torbjörn Fransson, Kalmar County Hospital, Sweden

Kalmar County Hospital, Sweden

- Beds: 372
- Staff: 2100
- Population served: 234000, with ~125000 in Kalmar itself
- Area covered: > 250km
- Patients seen daily: 1300
- X-ray department staff: 68 employees, 16 doctors

### Challenge

- Growing demand for interventional radiology and minimally-invasive surgery
- Interventional radiology performed in X-ray room with mobile C-arm for surgery
- Patient safety compromised by split between intervention and surgery
- Some complex procedures not possible

### Solution

- A Hybrid operating room for endoscopic cardiovascular surgery and X-ray, equipped with X-ray and imaging equipment from Philips; one of the first Hybrid operating rooms in Sweden
- Philips Allura Xper FD20 imaging, iU22 ultrasound and IntelliVue MP50 patient monitoring systems
- Minimally-invasive and open vascular surgery possible in the same room – 50 procedures in 2009
- Approximately 40% increase in interventional radiology procedures performed

Kalmar County Hospital is one of the first hospitals in Sweden to build a hybrid operating room (hybrid OR), incorporating equipment from Philips. The hospital was prompted by the potential risk to patients' lives caused by the double challenge of growing demand for minimally invasive surgery and separate radiology and surgery rooms.

Demand for minimally invasive surgery is growing worldwide. The benefits over open surgery are obvious: reduced pain, reduced costs, a smaller wound and faster recovery meaning a shorter hospital stay.

Vascular surgery is a major growth area for minimally invasive surgery. In 2008, 23% of all illness and death in Europe was caused by cardiovascular disease<sup>1</sup>. Coronary heart disease alone was the single biggest cause of death.

Kalmar County Hospital carries out the bulk of its vascular work in its own county. Interventional radiologists such as

Kalmar's Björn Holmgren perform minimally invasive procedures, including vascular procedures like angioplasty, using advanced imaging systems.

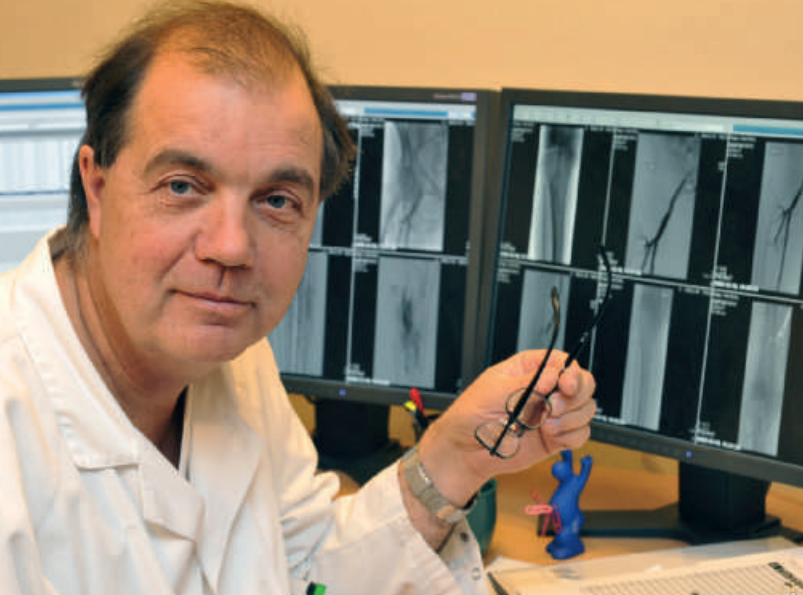
As soon as Kalmar's Philips V3000 Cath Angio radiology laboratory reached the end of its lifecycle, Dr. Holmgren masterminded the hospital's selection of a replacement which would be able to manage the increase in minimally invasive procedures. As a long-term user of Philips equipment such as the Philips Integris V3000, there was only one choice of supplier.

Kalmar's hybrid room features the following Philips equipment: an Allura Xper FD20 X-ray imaging system, an iU22 ultrasound and an IntelliVue MP50 patient monitor. Philips also supplied surgery lights and other essentials through third-party suppliers, for example two LED operating lamps with adjustable color balance.

### Minimizing the risk of infection

When it came to planning and selecting equipment for the hybrid room Dr. Holmgren's list of requirements was extensive. One of the major concerns was to ensure that interventional radiology took place in a sterile environment, particularly given the worldwide emergence of multiple drug-resistant bacteria.

<sup>1</sup> European cardiovascular disease statistics 200 - Steven Allender, Peter Scarborough, Viv Peto and Mike Rayner (British Heart Foundation Health Promotion Research Group / Department of Public Health, University of Oxford), Jose Leal, Ramon Luengo-Fernandez and Alastair Gray (Health Economics Research Centre, Department of Public Health, University of Oxford) – [www.ehnheart.org](http://www.ehnheart.org)



Dr. Holmgren

“We didn’t have any serious problems with infections, but we wanted to improve patient safety,” says Dr. Holmgren. “Our vascular work is significant in terms of the vascular surgery we perform and we tend to implant more foreign material into patients. When you implant foreign materials, there is always a risk of infection.”

Foreign material includes stent grafts - steel-reinforced Dacron or PTFE-Gore-Tex tubes used to keep a blood vessel open. Using aortic stent grafts to repair aortic aneurysms can be a problem: “You have lots of blood clots and dilation of the aorta. When you have blood clots, you have a potential breeding ground for germs,” he says. Any type of infection therefore has serious implications.

### High image quality

“If you cover one of the renal arteries when placing the stent, that kidney dies. Since there is no blood perfusion, it is vital to have proper imaging quality that allows you to see precisely what you are doing and that supports the exact placement of stent grafts.” Besides high image quality, ergonomics were also important to Dr. Holmgren, both for handling the equipment and for using the software.

Using the mobile C-arm in the ordinary operating theatres was not really a solution either. The view field is small, which is a major hindrance to peripheral work.

### Demand for complex procedures

Torbjörn Fransson, a consultant vascular surgeon, was also keen to update the operating facilities at Kalmar. “There were problems associated with advanced procedures. Kalmar Hospital was not an option for these procedures, instead you had to go to other hospitals,” he says.

The interventional radiology room was located on the third floor, below the open surgery rooms. If an interventional procedure failed to go as planned, the only option was to schedule an open surgical procedure for another time.

“For example, say you had planned a total endovascular revascularization procedure, and you couldn’t fulfill it because you couldn’t get through the occlusion with your equipment. The procedure would have to be abandoned and the patient sent home or back to the ward. We would then have to schedule a bypass procedure in the operating theatre, where open surgery would be performed. Not only is this a costly approach for the hospital, it is more stressful for the patient.

With the new hybrid OR, we can perform many different visceral revascularization procedures with adjunctive brachial access or retrograde access,” says Fransson. Bypass procedures that need to be combined with inflow or outflow adjunctive procedures as well as retrograde revascularization procedures of the legs are also easier now.

“We found the Philips equipment to be more user-friendly than that of their competitors”

### A Philips solution

Dr. Holmgren and his colleagues at Kalmar decided that a hybrid OR was the answer. Purchasing X-ray and imaging equipment from Philips was the obvious next step. “We found the Philips equipment to be more user-friendly than that of their competitors,” says Dr. Holmgren. “The controls and data on the computer were easier to work with, plus we were already familiar with Philips.”

Kalmar’s revolutionary solution was a hybrid OR – a fully equipped operating theatre and interventional radiology room. In a hybrid OR, interventional radiologists, vascular and other surgeons can perform both open and minimally invasive procedures – separately or at the same time.



Dr. Fransson

Completed in January 2009, the room is mainly used for vascular procedures and has handled around 400 patients already this year. According to Dr. Holmgren, the interventional radiology department has performed approximately 40% more procedures since the room went live.

Dr. Fransson, three interventional radiologists, a radiology student and a vascular surgery student use the room. According to staff, the room is fully booked nearly every day.



Dr. Fransson in one of the first hybrid operating rooms in Sweden.

“Staff work more efficiently because there is more space.”

#### Inside the hybrid room

Philips helped Dr. Holmgren plan the layout of the room, which is larger than a standard operating theatre. The room was built according to specifications from the radiology department. Dr. Fransson: “Staff work more efficiently because there is more space. Philips has organized the room and all the equipment very well – it’s now much easier to work than before.”

The room is sterile – staff enter through a sluice, ventilation was carefully designed during construction and the air is ultrafiltered. Preliminary results suggest Colony Forming Unit (CFU) counts are significantly lower compared with the old equipment. Another feature is the live connection between the examination room and a demonstration room, the aim being to have as few people as possible in the sterile environment.

#### High-performance, expectations met

Dr. Fransson provided the specifications for his ideal X-ray system and is delighted with the Philips solution, while Dr. Holmgren oversaw selection of the X-ray equipment and is also pleased with the Philips Allura. “We now have an excellent X-ray system with excellent performance and which is easy to operate. The options on the Allura system also allow for a seamless and efficient workflow, allowing us to spend more time on the patient.”

“The options on the Allura system allow us to spend more time on the patient”

One benefit is the built-in XperCT function for soft tissue imaging. “We can rotate around the patient while acquiring images and merge the information into a dataset – just like in a CT scan,” explains Dr. Holmgren.

“There is marginally less contrast compared with an ordinary CT, but the images are sufficiently clear. For example, you can check where you have placed a stent graft or look for endoleaks after placement of the stent graft. This means we can perform the first post-operative check-up while the patient is still on the table.”

In future, the hospital aims to use the XperCT to free up space in the CT room. A system is already in place for importing old CT scans or other exams to a monitor set, so when doctors are working with the Allura system they can refer back to previous examinations. “For instance, we use a gyro-mouse to run through a CT series or 3D reconstruction,” says Dr. Holmgren. Radiation doses can be reduced if older imaging information is immediately available, because it is possible to reach the region of interest more quickly. This is a major benefit in terms of speed.



Kalmar's revolutionary Hybrid OR solution

### Flexible ultrasound

Dr. Holmgren and Dr. Fransson are also delighted with the iU22 ultrasound system, which Dr. Fransson uses whenever he has problems making a puncture during minimally invasive procedures.

“When you are puncturing the forearm, sometimes it is hard to feel the pulse with the finger and you need the ultrasound to direct the needle more easily and with greater accuracy,” says Dr. Fransson. Dr. Holmgren uses the iU22 to examine inflow, outflow or the vascular bed for calcification, plaques or other obstacles during vascular work.

### Success with every procedure

The hybrid OR has transformed Kalmar County's radiology and surgery departments. Dr. Fransson: “Everything we could do before we can now do significantly better.” Not only that: “We are doing many more, and more advanced, procedures than we used to,” adds Dr. Holmgren. “The number of stent grafts has exploded,” he says. “We are treating patients we could not touch before because they were too ill to be treated by the vascular surgeons and the radiologists couldn't get the access they needed.” Dr. Fransson never has to abandon a procedure because, in the hybrid OR, he can switch between vascular and open surgery – when needed several times.

“We are doing many more, and more advanced, procedures than we used to – the number of stent grafts has exploded”

One or two days a week are set aside for these complex “hybrid” procedures. “Here you can start with a vascular procedure to try to get through an occluded artery,” he says. “But if you don't succeed, you can switch to open surgery, open up the groin and give the patient a bypass procedure instead.”

### Hybrid OR is the future

There has been major interest from other hospitals and vascular surgeons in Sweden, who recognize that this kind of hybrid room and this type of equipment represent the future in terms of working with vascular patients, says Dr. Fransson.

The news that Kalmar Hospital carries out new types of procedures have spread, and patients in need of complex surgery come

from nearby counties for treatment.

Dr. Fransson: “Patients with major health issues – aneurysms, for example – are satisfied when they come to us because procedures no longer have to be so invasive, which means they can be discharged in a couple of days.”

“There has been major interest from other hospitals and vascular surgeons in Sweden”

Few Swedish hospitals currently have a hybrid room, but this is now changing. The increase in minimally invasive surgery is convincing hospital managers that the time is right to invest. Dr. Fransson and Dr. Holmgren both recommend the Philips equipment to other surgeons. “I have done and will continue to do so,” says Dr. Holmgren. “It has worked superbly for a year – it is easy to understand, see and work with.” Dr. Fransson concurs: “I use the equipment for three whole days a week. I perform many open and vascular procedures and have had no problems.”



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