

Operating Room of the Future

St. Olavs Hospital HF, Department of Surgery

Annual report 2006



Contents

Operating room of the future, Department of Surgery	2
Today's patient treated with technology of tomorrow	2
Clinical work 2006	3
Laparoscopic treatment	3
Endovascular treatment	4
Teaching	5
Staff	5
Students	5
Courses / conferences	6
Visits at ORF	6
Research and development	7
Completed PhD-thesis, Master-thesis and other projects	7
Ongoing PhD - programs and other investigations/projects	8
Collaboration with other centers/industrial partners	10
Publications	11
Upgrading of medical technology	19
Staff	20
Organisation 2006	20
Economy / result	21
Future plans	22

Operating room of the future, Department of Surgery

Today's patient treated with technology of tomorrow

The "Operating room of the future" (ORF) is collaboration between St. Olavs Hospital and the Norwegian University of Science and Technology, Trondheim, Norway. Management on a daily basis is a responsibility which is shared by Department of Surgery and the Medical Faculty.

The two operating rooms at ORF are uniquely designed laboratories for the development, testing and application of new technology and treatment modalities. Research on safer and better patient treatment, more effective logistics and flexible architecture are important aims for the project. Through the contribution of our industrial collaborators in ORF, new prototypes can be developed and tested in close cooperation between clinicians, technologists and scientists in a safe way to form a basis for evidence-based surgery. The most recent equipment within our main research fields is available at ORF. A unique agreement with our industrial partners has made it possible for the Health Authorities of Central Norway and NTNU to focus on research and development in minimally invasive therapy.

ORF is created mainly to further development of minimally invasive therapy. We are focusing on laparoscopic surgery (key-hole surgery in the abdomen) and endovascular therapy for blood vessel diseases. This type of surgery is less traumatic than traditional open surgery and will have a broader application in the future.

Clinical work 2006

Laparoscopic treatment

Several of the operations have been performed for morbid obesity; altogether 31 procedures. 25 of these patients received a *Gastric Bypass* operation (*GBP*). They are part of a study where surgery is compared with 18 weeks of lifestyle modification. Five years follow-up is planned. ORF is taking part in an international multicenter study where a new operating method for morbid obesity is tested. A micro chip is implanted subcutaneously and can regulate the function of the vagal nerves via two small electrodes, which are connected to these nerves (*VBLOC*). So far 6 patients have been operated at ORF and 30 world-wide by this method. More operations are planned in 2007.

We have also performed laparoscopic surgery in other clinical sub-specialities like endocrine surgery. This includes 10 adrenalectomies where a new navigation technique has been applied. This technology has been developed and tested at SINTEF. The navigation technology has been used in altogether 15 patients (2004-2006). In 2007 we are starting an international multicenter study together with Mesos Medical Center in Utrecht, The Netherlands, testing navigation within laparoscopic surgery.

We have performed investigations using a 2 mm endoscope in the uterus (foetoscopy) with intervention on twins. This has been performed in collaboration with the National center for fetal medicine.

Clinical application to evaluate the possible advantages of high resolution video, so-called HD (*High Definition*), and *Narrow Band Imaging* (NBI) has been performed. Leading articles about the technology of ORF has been published in *Surgical Endoscopy* and in *European Hospital* in 2006. Several educational movies using HD-technology have been made for laparoscopic surgery, for the ORF-concept and for surgery of rectal carcinoma. These movies were shown at the World Conference of Endoscopic Surgery, Berlin September 2006 and at the Spanish Surgical Conference in Madrid, November 2006.

Activity laparoscopic surgery

Operations 2006

Fundoplication	4
Cholecystectomy	1
Gastric bypass	25
Blocking of the vagus nerve	6
Appendicostomy	1
Hernia repair	2
Adrenalectomy	10
Colectomy	1
Resection of the sigmoid colon	1
Low anterior resection	2
Explorative laparotomy	4
Total	57

Laparoscopic treatment, cont.

Gastroscopy	3
TEM (Transanal micro surgery)	1
	4

Endovascular treatment

89 procedures were performed in the suite for endovascular therapy/vascular surgery. 13 of these were emergency procedures. Operations have been performed for iliac-, abdominal- and thoracic aneurysms. Several combined procedures applying balloon angioplasty/stent application have been performed simultaneously with trombendarterectomy or bypass grafting. We have also performed diagnostic procedures for the testing of Dyna-CT technology. This is a new technology where the C-arm of the angiography unit is rotating. Thereby CT-like images can be provided on the operating table. This principle could be of major importance for the treatment of various vascular diseases, provided the image quality is sufficient. As part of a research protocol, 3D Dyna-CT imaging has been performed during elective abdominal aortic aneurysm repair where informed consent from the patient was obtained. Furthermore, Dyna-CT was applied during two interventions of the pelvic arteries and one thoracic aneurysm as a pilot for further research. Dyna-CT has also been used during phantom testing together with navigation.

Endovascular treatment has become more and more important in vascular trauma. In this field we think that this technology is representing a major advantage. The patients are often young and have been victims in traffic accidents. A common injury is partial rupture of the thoracic aorta. We have treated five patients and four of these have survived.

Activity endovascular therapy

Operations / procedures 2006

Thoracic stentgrafting	12
Abdominal stentgrafting	32
Iliac stentgrafting	10
Combined procedures (stenting and open operations)	35
Total	89

Acute procedures included in a total of 89

Thoracic aneurysms	4
Abdominal aneurysms	8
Thoracic trauma	1
Total	13

Teaching

ORF is a resource center for future integration and implementation of new technology and instruments in the operating area. Several of the departments, which have been built at St. Olavs Hospital during phase 1, as well as the planning in phase 2, is based on the knowledge which has been accumulated in the ORF. We have therefore learned how to implement new equipment and technology in our new integrated university hospital.

Staff

Education:

- Medical personnel affiliated to ORF are going through annual certification according to Norwegian National Regulations regarding use and maintenance of electromedical equipment § 13.
- We have certified some of the employees at ORF for the use of advanced medical technological equipment. They are going through regular courses to update their knowledge.
- The personnel at ORF are contributing to the teaching of personnel at other departments at St. Olavs Hospital and also personnel from other institutions, focusing on clinical procedures, research and the application of medical technology.
- ORF has been visited by personnel from other hospitals e.g. Stavanger, Follo etc. and thereby taken part in the dissemination of important information regarding new technology, methods, integration of laparoscopic/endoscopic surgery in the ORF and the lecture room.
- ORF has contributed with competence and knowledge in the start of endovascular therapy of aortic aneurysms at the University Hospital of Stavanger, where personnel has been visiting ORF. Our surgeons and radiologists have attended their first procedures.
- All courses at the National Center for Advanced Laparoscopic Surgery are using ORF as an arena for the transmission of operations and information regarding integration of new equipment.

Students

- On a regular basis operations are transmitted to the lecture room for medical students, nursing students, students in radiography etc from St. Olavs Hospital.
- Operating nurses and anaesthesia nurses have taken part in educational and tutorial activity.
- Visitors from other hospitals have attended ORF and have been present during operations.
- Master students as well as PhD candidates at St. Olavs Hospital / NTNU / SINTEF have a unique opportunity to see new medical technology and operations by being present in the interactive surgical lecture room in ORF.

Courses / conferences

- Course in simulator training for Norwegian cardiologists
- Interventional treatment of patients with vascular diseases, national course for surgeons and radiologists
- Two courses for operating nurses in laparoscopic surgery at the National Center for Advanced Laparoscopic Surgery (NSALK) / ORF (Tyco)
- Two courses including guided tour for PhD-candidates/medical students (about 45)
- "Northern Lights" conference at ORF/NSALK for 40 surgeons from UK (Olympus). See also www.nsalk.org
- Course for surgeons and gynecologists at NSALK with the topic: "Acute abdomen" including live demonstration of operations performed at ORF.
- Simulator course at NSALK for medical gastroenterologists and gastroenterological surgeons, including live demonstrations from ORF.
- HD live transmissions of laparoscopic operations during the 10th year anniversary of NSALK, which was combined with The Annual Surgical Summit Expert Course. Altogether 90 participants were present.
- EuroPACS 2006 conference in Trondheim included live transmissions using HD from operations performed at ORF.
- NSALK / SINTEF arranged a Symposium about ORF at the World Conference in Endoscopic Surgery (European Association of Endoscopic Surgery, EAES) in Berlin, June 2006. A HD video showing an operation at ORF was shown in addition to several other presentations. See www.congresses.eaes-eur.org

Visits at ORF

Altogether 60 external groups have visited ORF in 2006, 25 of these were international. The groups have consisted of delegations from other hospitals, hospital planners, members of the Norwegian parliament, members from the Norwegian government, architects and representatives from the industry and journalists. Several groups from the local organisation of the hospital building at St. Olavs Hospital have also been with us on a regular basis. In connection with most visits, oral presentations and/or operations have been presented from St. Olavs Hospital, NTNU and SINTEF.

Furthermore, participants from various national and international conferences have visited ORF as part of their program. **See Attachment 1.**

Scrub nurses, radiologists, anaesthesia nurses/anaesthesists, radiographers and surgeons both from national and international hospitals have been visitors at ORF.

Research and development

Completed PhD-thesis, Master-thesis and other projects

Three candidates have defended their PhD in 2006

Trine O. Eide

"Thoracoabdominal aortic aneurysm repair - Operative technique, pathophysiology and results of treatment", June 2006

Svein A. Jensen

"The prevalence of symptomatic arterial disease of the lower limb", Sept. 2006

Maria Ottermo, NTNU, Technical Cybernetics and NSALK

"Virtual Palpation Gripper", June 2006 (technology)

Master degrees

Camilla Berge

"Infrarenal abdominal aortic aneurysm repair. Time-trends and results during a 20-year period", November 2006 (health science)

Several other candidates at NTNU / SINTEF have made their master degree in connection with ORF and projects at NSALK / St. Olavs Hospital. Three candidates at Department of Circulation and Medical Imaging (ISB) (Guro H Vaarnes), Mathematics (Preben Nes) at NTNU and KTH (Stockholm)/SINTEF/NSALK (Lisa Nilsson) have included imaging and 3D-ultrasound in laparoscopic surgery, which is included in the navigation technology being tested at ORF.

Magnus Strømmen

"Obesity and health related quality of life study"
2006-2007 (health science)

Projects finished in 2006

"Packing of sterile instruments – a comparative study" (Report1-06) in collaboration with HiST – Sør-Trøndelag University College, Sterile supply, St. Olavs Hospital, Department of Surgery and ORF.

RFID for the tracking of disposable equipment in laparoscopic surgery. The project was performed as cooperation between SINTEF, NSALK and Lars Gåsø, who initiated the investigation. The study was supported by a grant from Central Norway Regional Health Authorities as a pilot study in ORF.

Ongoing PhD - programs and other investigations/projects

PhD projects

Frode Manstad-Hulaas, PhD, medicine

Application of navigation for deployment of stentgrafts with sidebranches. One paper based on phantom studies has been submitted. Animal investigations have been started. Use of navigation and Dyna-CT intraoperatively will most likely do these procedures simpler and safer.

Torbjørn Dahl, MD, Carotid artery stenosis – Diagnostic and therapeutic aspects

PhD-thesis has been delivered and includes movement analysis in the investigations of plaques of the internal carotid artery. Such plaques can be the origin of stroke and removal of plaques by surgery is performed prophylactically.

Håvard Nordgaard, PhD, medicine

Ultrasound-based blood flow imaging for intraoperative control during cardiovascular surgery. A new ultrasound based imaging of blood flow is used for intraoperative control of reconstructions of coronary artery and carotid arteries. One paper has been submitted and a project on carotid endarterectomy is in progress.

Berit Brattheim, PhD, health science

Evaluating teleradiological applications for suitability in endovascular therapy. This investigation will also focus on the application of teleradiology for follow-up. A cooperative effort with Department of Electronic Health Record (EHR) and various hospitals in central Norway.

Kari Ravn Eide, PhD, health science

Application on Dyna-CT during endovascular therapy of abdominal aneurysms. Dyna-CT is a new technology where a C-arm of the angiography unit in the operating room is rotating. This provides CT-like images during the operation. Our angiography laboratory is integrated with an operating room for open surgery. One paper has been published in Journal of Endovascular Therapy. Further plans are to apply Dyna-CT in patients with ruptured aneurysm and during EVAR for thoracic aneurysms.

Ole Vegard Solberg (SINTEF / St. Olavs Hospital)

3D ultrasound reconstruction and fusion with preoperative images for improved diagnostics and image guided therapy (PhD-technology)

Andreas Seim (St. Olavs Hospital / SINTEF / Norwegian Research Foundation)

PhD focusing on logistics and patient's flow. The PhD has been made in cooperation with Mass General Hospital, Boston and is going to be delivered in June 2007.

Study which is part of a PhD

Tor Erik Evjemo

Part of a PhD (NTNU / EHR) (Department of Electronic Health Record)

”Work and communication in a high-tech area”

PhD under planning

TBA, PhD student, NTNU / St. Olavs Hospital / SINTEF Health
3D ultrasound and navigation in laparoscopic surgery (medicine)

Other investigations and projects

For the application of navigation in laparoscopic surgery we have established collaboration with Mesos Medical Center, Utrecht, The Netherlands. We have a common research protocol and the cooperation is going to take place in the form a multicenter study.

Electromagnetic positioning in the operating room. We have collected data at ORF to investigate the potential and accuracy of equipment which is measuring orientation and position electromagnetically for use in the operating departments. We have used regular surgical instruments to study how these will influence the measurements. A scientific article describing the results of these tests is under preparation. The conclusion is that the electromagnetic positioning is possible. We will continue developing and testing of the method both in intravascular navigation and 3D laparoscopic ultrasound.

3D ultrasound in laparoscopic surgery. We are working on a solution based on micropositioning using a flexible ultrasound probe, which is going to be integrated in the navigation system CustusX. The solution so far has been tested in the laboratory to explore the accuracy. The application and the technical solution will then be tested in animal experiments in 2007. The intention is to visualise structures in experimental animals and then compare with Dyna-CT scans performed simultaneously on the operating table. This project is a part of two master degrees and one PhD.

High resolution (HD) video in laparoscopic surgery. We are collecting imaging in HD and standard video resolution (SD) under laparoscopy in animal studies to compare the qualities. The method is based on one large trocar opening where both types of endoscopes are placed intraperitoneally. Images are then collected from similar angles and distances from various organs and anatomical structures. After the experiments, comparison will be based on a blinded evaluation by several observers.

We are investigating how the positioning of patients on the operating table during laparoscopic surgery for morbid obesity can influence the incidence of complications.

Olympus has developed a prototype for a new operating lamp, which can replace traditional lamps. This is a development project for ORF and Olympus.

Siemens is also developing a prototype for a operating lamp specially designed for vascular surgery/endovascular therapy.

Sony and ORF / NSALK / SINTEF are working with virtual holographic light based room-monitor for interactive visualisation.

Collaboration with other centers/industrial partners

We have a good collaboration with our industrial partners; SONY, SIEMENS and OLYMPUS. In 2006 we also signed contracts with Tyco and MediStim.

We also have an excellent cooperation with MGH (Massachusetts General Hospital) in Boston within logistics and patient flow. One of our PhD candidates (A. Seim) has been visiting MGH several times and we have had visitors from MGH. This cooperation is going to continue in the future.

ORF also has a near cooperation with HiST – Sør-Trøndelag University College, the Medical Faculty, Norwegian University of Science and Technology, NSALK, SINTEF Health and National Center of Competence for the application of 3D ultrasound.

NSALK is represented via Ronald Mårvik, MD, as a member of the Technology Committee EAES, where annual conferences are being arranged. Through this membership and cooperation, ORF is used as an arena to demonstrate new concepts and show experiences with new technology. The committee is planning a visit to ORF at St. Olavs Hospital.

The EU project VECTOR (Versatile Endoscopic Capsule for gastrointestinal TumOr recognition and therapy) is an integrated project with 19 participants, including SINTEF and NSALK through SMIT (Society for Medical Innovation and Technology). The project started in 2006 and ORF will be an arena for testing of prototypes during this 4-year project. See www.vector-project.com for more information.

Established cooperation between NSALK / ORF and AV Arena Norway by Midgaard Medialab, NTNU. The aim with AV Arena Norway is to strengthen Norway as an international leading base of knowledge within new digital medias. The focus is industry and innovation. Midgaard Medialab has been involved in HD transmission to NOVA cinema in connection with conferences.

Publications

Articles in international journals with referee

Laparoscopic surgery: (5)

Mårvik R, Nesbakken R, Langø T, Yavuz Y, Bjelland H, Ottermo MV, Stavadahl Ø. Ergonomic design criteria for a novel laparoscopic tool handle with tactile feedback. *Minerva Chirurgica*, 61:5:435-44, 2006.

Yavuz Y, Skogås JG, Güllüoğlu MG, Langø T, Mårvik R. Are cold light sources really cold? *Surg Laparosc Endosc Percutan Tech*, 16:5:370-6, 2006.

Yavuz Y, Rønning K, Bakkeland K, Lyng O, Aadahl P, Mårvik R, Grønbech JE. Hemodynamic and tissue blood flow responses to long-term pneumoperitoneum and hypercapnia in the pig. *Surg Endosc*, 20:9:1394-1401, 2006.

Mårvik R, Langø T. High-definition television in medicine. Editorial in *Surg Endosc*, 20:3:349-50.

Ottermo MV, Øvstedal M, Langø T, Stavadahl Ø, Yavuz Y, Johansen TA, Mårvik R. The Role of Tactile Feedback in Laparoscopic Surgery. In Press in *Surg Laparosc Endosc Percutan Tech*, 2006.

Endovascular therapy (7)

Eide TO, Romundstad PR, Stenseth R, Aadahl P, Myhre HO. Spinal fluid dynamics during thoracic- and thoracoabdominal aortic surgery. *Int Angiol* 2006; 25: 46-51.

Brekken R, Bang J, Ødegård A, Aasland J, Hernes TAN, Myhre HO. Strain estimation in abdominal aortic aneurysms from 2D ultrasound. *J Ultrasound Med Biol* 2006; 32:1:33-42.

Ødegård A, Aasland J, Myhre HO, Mollnes TE, Videm V. The inflammatory response to stentgrafting of the thoracic aorta. Accepted *Int Angiol*, 2006.

Dahl T, Aasland J, Romundstad P, Johnsen HJ, Myhre HO. Carotid endarterectomy: time-trends and results during a 20-year period. *Int Angiol*, 2006; 25: 241-8.

Dahl T, Rudjord K, Altreuther M, Myhre HO. Data quality of surgery for carotid artery stenosis. Are the national vascular registries reliable? *Eur J Vasc Endovasc Surg*. Apr;31:4:381-5. 2006.

Ravn-Eide K, Ødegård A, Myhre HO, Haraldseth O. Initial observations of endovascular aneurysm repair using Dyna-CT. *J Endovasc Ther* 2007; 14: 50-53.

Berge C, Ødegård A, Lange C, Myhre HO. Infrarenal abdominal aortic aneurysm repair. Time-trends and results during a 20-year period. Submitted, *World J Surg*, 2006.

Articles in national scientific journals with referee (2)

Dahl T, Myhre HO, Johnsen HJ. Surgical treatment of carotid stenosis in Norway. Tidsskr Nor Lægeforen, May;25;126:11:1466-9, 2006.

Myhre HO. Karkirurgien 1980-2005. Jubileumsnummer Tidsskr Nor Lægeforen nr 1, 2006; 100-101.

General ORF

Articles in international journals with referee (6)

Andreas Seim, Bjørn Andersen, Warren Sandberg, Statistical Process Control as a Tool for Monitoring Non-Operative Time. Anesthesiology, 2006;103:406-418

Seim AR, Fagerhaug T, Ryen SM, Curran P, Sæther OD, Myhre HO, Sandberg WS. Causes of cancellations on day of surgery at two major university hospitals. Submitted to World Journal of Surgery.

Seim AR, Sandberg WS. Statistical Process Control of Operating Room Metrics Detects the Impact of Congestion in the Recovery Room. Submitted to Anesthesia & Analgesia.

Ehrenfeld J, Seim AR, Berger DL, Sandberg WS. Characteristics of Patients Successfully Discharged Directly from the Recovery Room After Laparoscopic Cholecystectomy. Submitted to Anesthesiology.

Andreas Seim, Bjørn Andersen, David Berger, Suzanne Sokal, Warren Sandberg, Impact on PACU Workload of a Direct-From-PACU Discharge Pathway for Laparoscopic Cholecystectomy Patients. Surgical Innovation, 2006;13:4: 257-264

Nesbakken R, Langø T, Færevik H, Holbø K, Reitan J, Yavuz Y, Mårvik R. Design of cooling vest for surgery. Submitted to Appl Ergon, 2006.

Oral presentations at international conferences (36)

Langø T. Navigation within laparoscopic surgery. Presentation at seminar: Northern lights – The future of imaging in surgery. Programme: National Center for Advanced Laparoscopic Surgery, St. Olavs Hospital and Olympus. March 5-6, Trondheim, 2006.

Myhre HO. Percutaneous Endovascular Therapy. OLYMPUS – Northern Lights – The future of imaging in surgery. Trondheim, 05.-06.03.06.

Langø T, Mårvik R, Ystgaard B, Tangen GA, Wollf A, Hernes TAN. Navigation in laparoscopy. Oral presentation at the Surgical Endoscopy Expert Summit 2006, Trondheim-Cairo University, Cairo, Egypt.: “ Navigation in laparoscopic Surgery”, 3 April 2006

Mårvik R, The National Hepatology for Tropical Medicine Research Institute. The Scientific Group of Gastroenterology & Hepatology. “The future operating room at St. Olavs Hospital”, Cairo 4 April 2006

Mårvik R, Mediterranean Society of Pelvic Floor Disorders – “Laparoscopic Treatment of Rectal Prolapse”, Cairo 7 April 2006

Ystgaard B, Skogås JG, Yavuz Y, Langø T, Kaspersen JH, Ommedal S, Tangen GA, Hernes TAN, Mårvik R. Future operating room in Trondheim. Oral presentation at the 18th annual SMIT (Society of Medical Innovation and Technology) conference, Pacific Grove, Monterey, CA, USA, May 11-14, 2006.

Ystgaard B, Skogås JG, Eggen J, Ødegård A, Myhre HO. How do we construct operating rooms for treatment of vascular disease? SMIT (Society of Medical Innovation and Technology) conference, Pacific Grove, Monterey, CA, USA, May 11-14, 2006.

Yavuz Y, Skogås JG, Güllüoğlu MG, Langø T, Mårvik R. Are cold light sources really cold? Oral presentation at the 18th annual SMIT (Society of Medical Innovation and Technology) conference, Pacific Grove, Monterey, CA, USA, May 11-14, 2006.

Yavuz Y, Langø T, Nesbakken R, Hernes TAN, Reitan J, Stavdahl Ø, Mårvik R. Improving working conditions in laparoscopic surgery. Oral presentation at the 18th annual SMIT (Society of Medical Innovation and Technology) conference, Pacific Grove, Monterey, CA, USA, May 11-14, 2006.

Langø T, Yavuz Y, Güllüoğlu MG, Ystgaard B, Mårvik R. Monitoring and comparison of bipolar and monopolar radiofrequency ablation. Oral presentation at the 18th annual SMIT (Society of Medical Innovation and Technology) conference, Pacific Grove, Monterey, CA, USA, May 11-14, 2006.

Ystgaard B, Mårvik R, Skogås JG, Yavuz Y, Langø T, Hernes TAN. Initial experiences using prototype HD camera in endoscopy. Oral presentation at the 18th annual SMIT (Society of Medical Innovation and Technology) conference, Pacific Grove, Monterey, CA, USA, May 11-14, 2006.

Langø T, Tangen GA, Ystgaard B, Yavuz Y, Kaspersen JH, Wollf A, Solberg OV, Hernes TAN, Mårvik R. 3D navigation in laparoscopic surgery. Oral and poster presentation at the 18th annual SMIT (Society of Medical Innovation and Technology) conference, Pacific Grove, Monterey, CA, USA, May 11-14, 2006. Nominated for poster award session.

Skogaas JG, Liverod V. The Challenge of Visible Light in PACS, EuroPacs Conference, June 2006, Trondheim, Norway.

Hernes TAN, Kaspersen JH, Langø T, Lindseth F, Selbekk T, Wollf A, Solberg OV, Tangen GA, Myhre HO, Mårvik R, Unsgaard G. Multiradiological 2D and 3D interfaces for Interactive diagnostics, treatment guidance and follow up of patients, EuroPacs Conference, June 2006, Trondheim, Norway.

Manstad-Hulaas,F. 3D navigation for aortic stenting. EuroPacs Conference,june 2006,Trondheim,Norway

R. Mårvik, The Operating Room of the Future. 14th International Congress of the European Association of Laparoscopic Surgery: Symposium, Berlin, 12 September 2006

Mårvik R. Endovascular and endoscopic surgery (entire setup incl. education, Sony-System, Siemens, Olympus EndoAlpha, missing OR lights). Invited lecture presentation at the 10th World Congress of Endoscopic Surgery hosted by the EAES and incorporating the 14th International Congress of the European Association for Endoscopic Surgery (EAES). Berlin, Germany, 13-16 September, 2006.

Langø T. Navigation for endoscopic surgery. Invited lecture presentation at the at the 10th World Congress of Endoscopic Surgery hosted by the EAES and incorporating the 14th International Congress of the European Association for Endoscopic Surgery (EAES). Berlin, Germany, 13-16 September, 2006.

Langø T. Integration of High Tech: Intraoperative imaging, navigation and robotics. Invited lecture presentation at the at the Technology Symposium of the 10th World Congress of Endoscopic Surgery hosted by the EAES and incorporating the 14th International Congress of the European Association for Endoscopic Surgery (EAES). Berlin, Germany, 13-16 September, 2006.

Ystgaard B, Langø T, Yavuz Y, Kaspersen JH, Tangen GA, Nagelhus Hernes TA, Mårvik R. Future Operating Room in Trondheim. Oral presentation at the at the 10th World Congress of Endoscopic Surgery hosted by the EAES and incorporating the 14th International Congress of the European Association for Endoscopic Surgery (EAES). Berlin, Germany, 13-16 September, 2006.

Mårvik R. HDTV video presentation of the “Future Operating Rooms” at St. Olavs Hospital, Trondheim OR (setup and concept). Invited lecture presentation at the Technology Symposium of the 10th World Congress of Endoscopic Surgery hosted by the EAES and incorporating the 14th International Congress of the European Association for Endoscopic Surgery (EAES). Berlin, Germany, 13-16 September, 2006.

Hernes TAN, Myhre HO, Mårvik R, Unsgård G, Langø T, Kaspersen JH, Selbekk T, Lindseth F, Tangen GA, Hansen R, Brekken R, Christiansen FH, Rasmussen I, Dahl T, Ødegård A, Gribbestad I, Angelsen BAJ, Torp H, Haraldseth O. Ultrasound and MR for improved diagnostics, therapy monitoring, activation and control. Poster presentation at the ESF-UB Conference in Nanomedicine, European Science Foundation, Barcelona, 15-20 september 2006.

Tangen GA, Langø T, Ystgaard B, Yavuz Y, Kaspersen JH, Wolf A, Solberg OV, Nagelhus Hernes TA, Mårvik R. 3D Navigation in laparoscopic surgery. Oral presentation at the at the 10th World Congress of Endoscopic Surgery hosted by the EAES and incorporating the 14th International Congress of the European Association for Endoscopic Surgery (EAES). Berlin, Germany, 13-16 September, 2006.

Myhre HO, Ødegård A. Aortic Dissections. Revision Course at the Annual Meeting of European Society for Vascular Surgery, Prague, 21st Sept 2006.

Mårvik R, Langø T, Ystgaard B et. al. Future operating room for laparoscopy - imaging and display technology sets new demands. Oral presentation at the Surgical Endoscopy Expert Summit 2006, Trondheim-Bergen, October 13-16, 2006.

Mårvik R, Langø T, Ystgaard B et. al. HDTV in laparoscopy, clinical examples and new technology in obesity surgery. Oral presentation at the Surgical Endoscopy Expert Summit 2006, Trondheim-Bergen, October 13-16, 2006.

Langø T, Mårvik R, Ystgaard B, Tangen GA, Solberg OV, Hernes TAN. 3D ultrasound and other new technology developments in laparoscopy. Oral presentation at the Surgical Endoscopy Expert Summit 2006, Trondheim-Bergen, October 13-16, 2006.

R. Mårvik. Navigation in Laparoscopic Surgery. 14th International Laparoscopic Surgery Symposium, Bordeaux, 2-4 November, 2006:

R. Mårvik. The HD in the Future Operating Room. 14th International Laparoscopic Surgery Symposium, Bordeaux, 2-4 November, 2006

Myhre HO. Image guided surgery and intervention. Workshop European Science Foundation, Trondheim, Nov 2nd, 2006.

Seim AR, Ehrenfeld J, Sandberg WS. Detecting Changes in Perioperative System Performance Using Statistical Process Control. Presented at International Anesthesia Research Society 80th Clinical & Scientific Congress (2006).

Sandberg WS, Ryen SM, Curran PK, Seim AR. Causes of Cancellations on the Day of Surgery at Two Major University Hospitals. Presented at the 2006 Annual Meeting of the American Society of Anesthesiologists.

Sandberg WS, Springer SF, Anupama S, Seim AR, Ehrenfeld JM. Improving Documentation Quality with Automated Anesthesia Information Management. Presented at the 2006 Annual Meeting of the American Society of Anesthesiologists.

Sandberg WS, Sokal SM, Berger DL, Seim AR. Impact on PACU Workload of a Direct-From-PACU Discharge Pathway after Laparoscopic Cholecystectomy. Presented at the 2006 Annual Meeting of the American Society of Anesthesiologists.

Henriksen B, Olsson N, Seim AR. Adjustments, effectiveness and efficiency in Norwegian hospital construction and rehabilitation projects. Paper accepted for presentation at CIB W70 Trondheim International Symposium on Changing User Demands on Buildings, Trondheim, Norway, 12–14 June 2006.

Myhre HO, Mårvik R. Fremtidens operasjonsrom ved St. Olavs Hospital/NTNU, - Visjoner og muligheter. Norsk Forening for Automatisering. Medisinsk Teknologi – Fremtidens teknologi for et bedre helsevesen. Medisinsk Teknisk Senter/St. Olavs Hospital, Trondheim, 13.-14.02.06

Presentations at national scientific conferences (6)

Langø T. Teknologi for bedre kommunikasjon, dokumentasjon og logistikk i operasjonsstuen. Presentasjon på seminar i Medisinsk Teknologi – Fremtidens teknologi for et bedre helsevesen, 13.-14. februar, 2006. Arrangør: Norsk Forening for automatisering (NFA).

Lange C, Hatlinghus S, Ødegård A, Aasland J, Myhre HO. 11 år med stentgraftbehandling for AAA. Norsk Karkirurgisk Forenings Vintermøte, Geilo, 09.-12. mars 2006.

Langø T. Hvordan blir fremtidens operasjonsstue? Invitert foredrag på NSH (Norsk Sykehus- og Helsetjenesteforening) konferanse i samarbeid med Arkitektforum for Helsebygg (Kompetansenettverk for Sykehusplanlegging): Sykehusutbygging i framtidens helsetjeneste - Hva skjer mot 2025? Oslo Kongressenter, Folkets Hus, 31. mars 2006.

Skogås JG, Fremtidens Operasjonsrom med fokus på moderne medisinsk teknologi. Medisinsk Teknisk Forening, MTF, Gardermoen, 8 til 9 mars 2006

Eide KR, Ødegård A, Myhre HO, Haraldseth O. Dyna-CT – En ny avbildningsteknikk ved endovaskulær terapi. Vitenskapelige forhandlinger, Norsk Kirurgisk Forening, okt.06, s.325

Lange C, Hatlinghus S, Ødegård A, Aasland J, Myhre HO. Stentgraftbehandling av sykdommer i thoracalaorta i Trondheim 1997-2006. Vitenskapelige forhandlinger, Norsk Kirurgisk Forening, okt.06, s.321

Other seminars and courses (11)

Langø T. Imaging and video in the operating theatre. Oral presentation during the Trondheim Study Tour; Medisch Centrum Alkmaar, Nederland. November 23, 2006.

Myhre HO. Future operating room. NSALK 10 år, NOVA 16.10.06

Mårvik R. Myhre HO, Medisinsk Teknologi. Fremtidens teknologi for et bedre helsevesen. 13-14. februar, 2006, St. Olavs Hospital, Trondheim.

Mårvik R. Johnsen G, Ystgaard B. Laparoskopi ved akutt abdomen. Kurs for operasjonssykepleiere, NSALK, St. Olavs Hospital, 2-3. mai 2006.

Mårvik R, Skogås JG, Future operating room. Tokyo, Sony R/D, januar 2006

Mårvik R. Nye utfordringer ved minimal invasiv kirurgi. Kurs for operasjonssykepleiere, NSALK, St. Olavs Hospital, 2-3. mai 2006.

Aasland J. Emballasje av sterile instrumenter – en sammenligningsstudie. Temadag om FOU arbeid ved Kirurgisk Klinikk, St. Olavs Hospital, Trondheim, 26.10.2006

Wik AK. Utfordringer for operasjonssykepleiere som jobber i et høyteknologisk miljø. Kurs for operasjonssykepleiere, NSALK, St. Olavs Hospital, 2-3. mai 2006.

Torvik R. Leiring av pasienter til laparoskopisk colonkirurgi. Kurs for operasjonssykepleiere, NSALK, St. Olavs Hospital, 2-3. mai 2006.

Wik AK. Kartleggingsstudie. Temadag om FOU arbeid ved Kirurgisk Klinikk, St. Olavs Hospital, 26. oktober 2006.

Wik AK. Kartleggingsstudie av eventuelle komplikasjoner etter leiring av pasienter som har fått utført laparoskopisk gastric bypass operasjon. Kurs for operasjonssykepleiere, NSALK, St. Olavs Hospital, 20. november 2006.

Popular science in newspapers and magazines (15)

Kniven følger kartet. Aftenposten, 29. november, 2006, s. 6. Artikkel om navigasjon i laparoskopisk kirurgi og samarbeidet med Utrecht, Nederland.
<http://www.aftenposten.no/helse/article1549799.ece>

Bondø T H. Her er teknopillen som skal finne kreft. VG, lørdag 18. november, 2006, s 22-23. Artikkel om EU prosjektet VECTOR.

Tønseth S. På tokt i tarmen. Gemini, nr 5, november 2006, s.16-17. Artikkel om EU prosjektet VECTOR. http://www.ntnu.no/gemini/2006-05/rep_tarmen.htm

Mårvik R, Langø T. HDTV advantages lead to medical advances. European Hospital; vol 15, issue 4, page 20-21, 2006.

Dragsland Å. Kirurgen må kjøles ned. Artikkel i Byavisa, Trondheim, Tirsdag 7. februar 2006.

Myhre HO, Mårvik R, Skogås JG, Ødegård A, Sund V, Eggen J, Aadahl P. Fremtidens operasjonsrom i Trondheim. Kirurgen nr 2/2006

Sund V. Synergies breed biotech success. Norway exports - research & development 2006.

Kaspersen JH, SINTEF Helse. "Med GPS i pulsåra", GEMINI, nr. 4, 2006,

Tønseth S. "Med GPS i pulsåra". Pulsen, nr 4, 2006. Artikkel om navigasjon i forbindelse med AAA operasjoner. **Received gold prize for the best Norwegian article in the category "Magazines for Norwegian companies" in 2006.**

Kikkhullskirurgi. Verdt å vite spalte i Dagen Næringsliv, 23. desember 2006

Seim, Andreas Røsland; Sandberg, Warren. Operating Room of the Future: More Than a Funny Name. Kirurgen 2006(2):13-16

"Operasjoner på kino" Schrödingers katt, NRK. 9.3.2006.
http://www.nrk.no/programmer/tv/schrodingers_katt/5543118.html

”En inn i kroppen opplevelse” - overføring av operasjon til Nova kino. Dagens Næringsliv, 14.6.2006.

”Operasjonsbilder tok pusten fra ekspertene” – Trondheim i medisinsk verdensklasse. Adresseavisen, 15.6.2006.

”NTNU gjør kinoen digital - 40 britiske kirurger på Nova kino for å se en operasjon tatt opp ved St. Olavs Hospital. Adressa.no. 4.3.2006.

<http://www.adressa.no/nyheter/trondheim/article628097.ece>

Prøver ut datachip mot fedme. Artikkel i Adressa, NTB. 15.07. 2006.

<http://www.adressa.no/nyheter/innenriks/article689117.ece>

Nordområdekonferanse, Tromsø, 2006. Bildemateriale til presentasjon fra det norske utenriksdepartement.

Publications on the Internet

Live demo from the Operating Room of the Future to the 60 square meter screen at Nove Conference Centre. High Definition Images from the laparoscopic camera to the 4K digital projector.

http://www.europacs.net/images_pre.htm

Europacs 2006

http://www.helse-midt.no/templates/page_66658.aspx

Digital kino

<http://www.forskning.no/Artikler/2006/mars/1141379868.23>

Interviews, popular science (1)

Sund V. NRK - Midt i trafikken. Intervju om medisinske og teknologiske muligheter som ligger i Fremtidens operasjonsrom, februar 2006.

Upgrading of medical technology

- Upgrading of ceiling mounted arm in room 2 for EndoAlpha and anaesthesiology.
- Upgrading EndoAlpha with light source and endoscopy processor giving common platform for flexible and rigid endoscopes including HD format 1080i.
- Development of wireless communication between video sources and sources for visualisation.
- Replaced DVCAM recorders with DVD recorders in both operating rooms.
- Upgrading and replacement of flat screens for laparoscopic procedure of OR2, upgrading to full HD 1920 x 1080 input.
- Installed HD/SDI interface from OR1 and OR2 applying Sony-HD-structure. This makes it possible to send HD-format from ORF during video conferences.
- Installation of 46" flat screen in OR1, to improve visualisation during endovascular procedures.
- Upgrading of video signals from OR1 to the lecture room to show angiographic images and images processed by the Leonardo work station in HD. These images can then be sent via fiber optic connection from ORF.
- Upgrading and replacement of flat screens in the lecture room from SD to HD.
- Installation of fiber optic connection from ORF via Neuro center, phase 1, and further from St. Olavs Hospital in collaboration with Midgaard Medialab.
- In 2006 we made the first live transmission in HD in Europe. This was made from the operating room to Nova Cinema in connection with the conference Europacs 2006.
- We have installed PACS workstation with 2-screen solution in our control room, which will facilitate the work for clinicians.
- We have also installed MAC-computer for research work within endovascular therapy.
- Upgrading of servers and network based on Sony's structure, AV/ICT.
- All touch panels have been reprogrammed twice to make them function with hardware upgrading which has been performed.
- Installation of new editing software and training.
- We have made and installed a coupling panel to simplify HD transmissions from ORF.

The upgrading of new technology in 2006 has a value of NOK 890.000,-. These costs have been covered by our industrial collaborators through the research collaboration agreements.

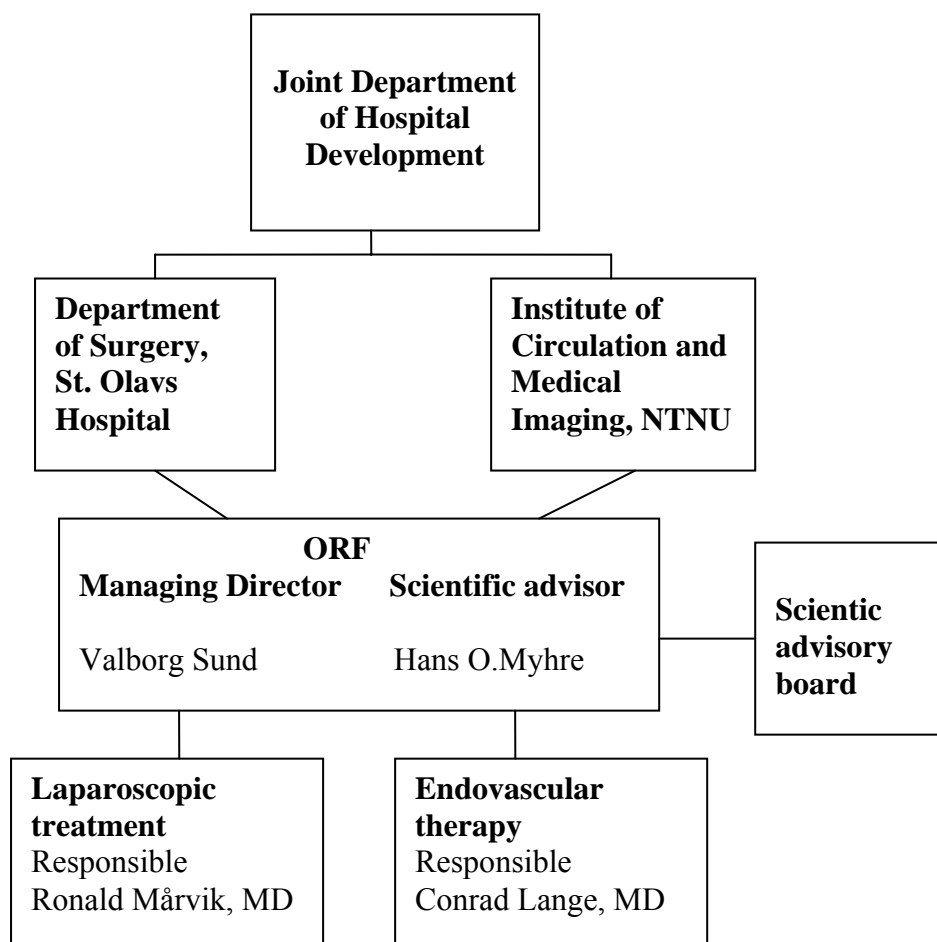
Staff

1 managing director
1 responsible for medical technology
1 research nurse endovascular therapy
1 research nurse laparoscopic therapy

Other resources connected to ORF

2 project leaders, one for endovascular and one for laparoscopic therapy respectively
Operating nurse, endovascular therapy
Operating nurse, laparoscopic therapy
Radiographer
Anaesthesia nurse

Organisation 2006



From January 2007 Jan Gunnar Skogås has been employed as Managing Director.
From October 2006 Torbjørn Dahl is responsible for endovascular therapy.

Economy / result

In NOK		
	Account	Transferred to 2007
	2006	
Disposable equipment	12 103	
Salaries	1 955 141	
Technical equipment	416 221	
Other costs	116 535	
Total costs	2 500 000	
Research grant 2006	2 500 000	
Result 2006*	0	
Positive balance transferred to 2007		0

Future plans

The personnell involved in running ORF are to a great extent financed from external sources. Therefore it is possible to have a good scientific activity in spite of a limited annual budget. More resources for running the unit would have made it possible to increase the clinical activity on a higher level than we are able to carry out today.

Our goal is to continue the activity at ORF and to develop a center of competence within construction and administration of operating departments. At present we are building several new hospitals in Norway and it is important to test out new concepts regarding construction, use of materials and administration of operating rooms in a systematic way.

Another aim is to strengthen the international cooperation. We are approaching Massachusetts General Hospital (Boston), Operating room of the future in Tübingen by Ulrich Mathern (Germany), EAES, SMIT, and other EU project initiatives. Several hospitals and research groups in Poland (for example endoscopic surgery at Krakow University Hospital by M Duplaga) have been in contact with us to start projects.

There is a need to extend indications for stentgraft treatment both for aneurysmal disease, dissections and arterial trauma. We think this can be done by using modified stentgrafts with sidebranches to the visceral arteries. We also consider the application of scalloping and fenestration as important. One of our research projects is to apply navigation for the application of such stentgrafts. Furthermore, we think that the mortality following ruptured abdominal aortic aneurysm can be decreased by using stentgrafting, and it is our plan to do this at ORF.

We wish to use ORF to a greater extent in the education of medical students, nursing students and in the teaching of specialist candidates, engineers etc. We are planning a course for engineers from SINTEF in the near future.

Furthermore, we need to have simulators on a regular basis. Simulators can be used both in laparoscopic surgery and in endovascular therapy. Such appliances will be necessary in the teaching of surgeons, radiologists and cardiologists. We think that this should be done as collaboration between NSALK, the Department of Cardiology, the Department of Circulation and Medical Imaging, the Department of Surgery and the Medical Simulation Centre. We will open new facilities (reconstruction of NSALK, planned opening 2008) with 8 laparoscopic simulators and 4 simulators for flexible endoscopes.

For several years we have discussed the possibility of using holograms and advanced methods of visualisation in the operating room. This can be used both as a diagnostic tool and an aid during operations. Some of our industrial collaborators have now come forward with ideas, which make these thoughts closer to reality.

Trondheim, March 2007



Hans Olav Myhre, MD
Scientific advisor



Jan Gunnar Skogås
Managing Director



Torbjørn Dahl, MD
Responsible Endovascular therapy



Ronald Mårvik, MD
Responsible Laparoscopic surgery

Visits and excursions - 2006

25.01	Teachers from HiNT - Nord-Trøndelag University College
27.01	Board, St.Olavs Hospital, Trondheim
03.02	Copenhagen Capacity
06.02	Representatives from Aalborg hospital, Denmark (Sony)
07.02	Sony, Department Japan
08.02	Journalist from the Radiographers Magazine
09.02	Surgeons from Mesos, Utrecht, The Netherlands
09.02	Representatives from Erasmus University Hospital, Rotterdam
13.02	National Seminar for Medical Technology
15.02	Representatives from Siemens, Germany
22.02	Tokyo University, media-department and Midgaard Medialab
27.02	Members of the Norwegian parliament
03.03	Representatives from Olympus, Scandinavia
05.03	Northern Lights Conference, 40 surgeons from UK, Olympus
16.03	Representatives from Olympus, Japan
23.03	KITH, Norwegian Centre for Informatics in Health and Social Care
24.03	Course NSALK, "live" operations
27.03	Hospital planners from Sahlgrenska Hospital, Gothenburg, Sweden
27.03	Students in architecture, NTNU
05.04	Medical Technology, Health Region of Central Norway
05.04	Hospital Development for Central Norway, international hospital planners
24.04	National course in vascular surgery, transmission of operations
25.04	Course in vascular surgery
27.04	Symposium at HINT - Nord-Trøndelag University College, teachers and pupils at the school from Nord-Trøndelag county
02.05	International course for operating room nurses, Tyco
02.05	Hospital administration from Østersund hospital, Sweden
16.05	Representatives from Washington, Georgetown University Hospital
26.05	Visit from Olympus and Sony, England
22.05	Simulator course, NSALK, transmission from operation
01.06	Teknologer fra Tusla, Bosnia-Herzegovina, SINTEF Teknologi og Samfunn / Rikshospitalet, Bergsland
07.06	Sales managers, Olympus, Scandinavia
09.06	Innovation Norway, SINTEF Innovation and Mid-Norway Chamber of Commerce and Industry, NTNU
14.06	Live transmissions of operations from room 1 and 2 to NOVA Cinema in connection with Preconference EuroPACS
15/16.06	Visits from Europe, Japan and China (200 participants) in connection with the conference EuroPacs
16.06	Visits by Norwegian urologists (spring meeting of the Norwegian Society for Urology)
16.06	The board of EuroPACS
18.08	Engineers, Finland
25.08	Department of Surgery, Namdal hospital, Nord-Trøndelag county

30.08	Innovation Norway, The board
30.08	Project group "New interventional lab", University Hospital of Stavanger (radiologists, nurses, surgeons and radiographers)
06.09	Technical personnel, Central Norway Regional Health Authorities
07.09	Visit from Japan
27.09	Course and presentation for PhD-candidates (45)
02.10	Chief of departments, members of the staff, University Hospital of Stavanger
04.10	Course for medical students (16)
06.10	Central Norway Regional Health Authorities (13)
16.10	Live transmission of operations from OR2 to NOVA, NSALK 10 year anniversary
20.10	Hospital planners and administrators from two hospitals in the Netherlands
23.10	Hospital Development Project for Central Norway, transmission from OR2 (15 participants)
27.10	Visit from Tampere University Hospital, Finland
20/21.11	Tyco- course for operating nurses, (20)
23/24.11	Norwegian course for cardiologists – simulator training (Boston Scientific)
05/12	The board, Society for Medical Technology
11/12	Hospital administrators, Kristiansand Hospital

Collaborators from medical companies



SIEMENS

SONY

tyco

Healthcare

Research collaboration



www.stolav.no/for