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Emergency treatment in a neurosurgical hybrid operating room

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Illustrated workflows in hybrid operating rooms, No. 7

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Taichung Veterans General Hospital is located in central Taiwan and began offering medical services in 1982. Since 1991 it has been accredited as a “Medical Center and First-Class Teaching Hospital” by the Department of Health, Taiwan. Taichung Veterans General Hospital is a 1,500-bed hospital with about 3,000 employees. It can care for 6,000 outpatients, 140 inpatients, and 180 patients in the emergency room daily. As a public medical center, it provides safe, high-quality medical services with advanced facilities and training programs as well as outstanding research and development programs.

The Department of Neurosurgery offers comprehensive treatment options for complex neurosurgical disorders that include minimally invasive keyhole skull base brain surgery with endoscope and microscope, brain surgery on awake patients, minimally invasive spine surgery and percutaneous spinal stabilization using stereotactic navigation systems, deep brain stimulation for Parkinson’s disease, and gamma knife radiosurgery.

Since 2009, Dr. Chiung-Chyi Shen (center) and his team Dr. Yuang-Seng Tsuei (right) and Dr. Wen-Yu Cheng (left) have established innovative surgical workflows in their hybrid operating room to treat cerebrovascular lesions, resect pituitary tumors under 3D image guidance, and ensure fast and high-quality care for emergency patients.



臺中榮民總醫院 影像導引手術室



Clinical case

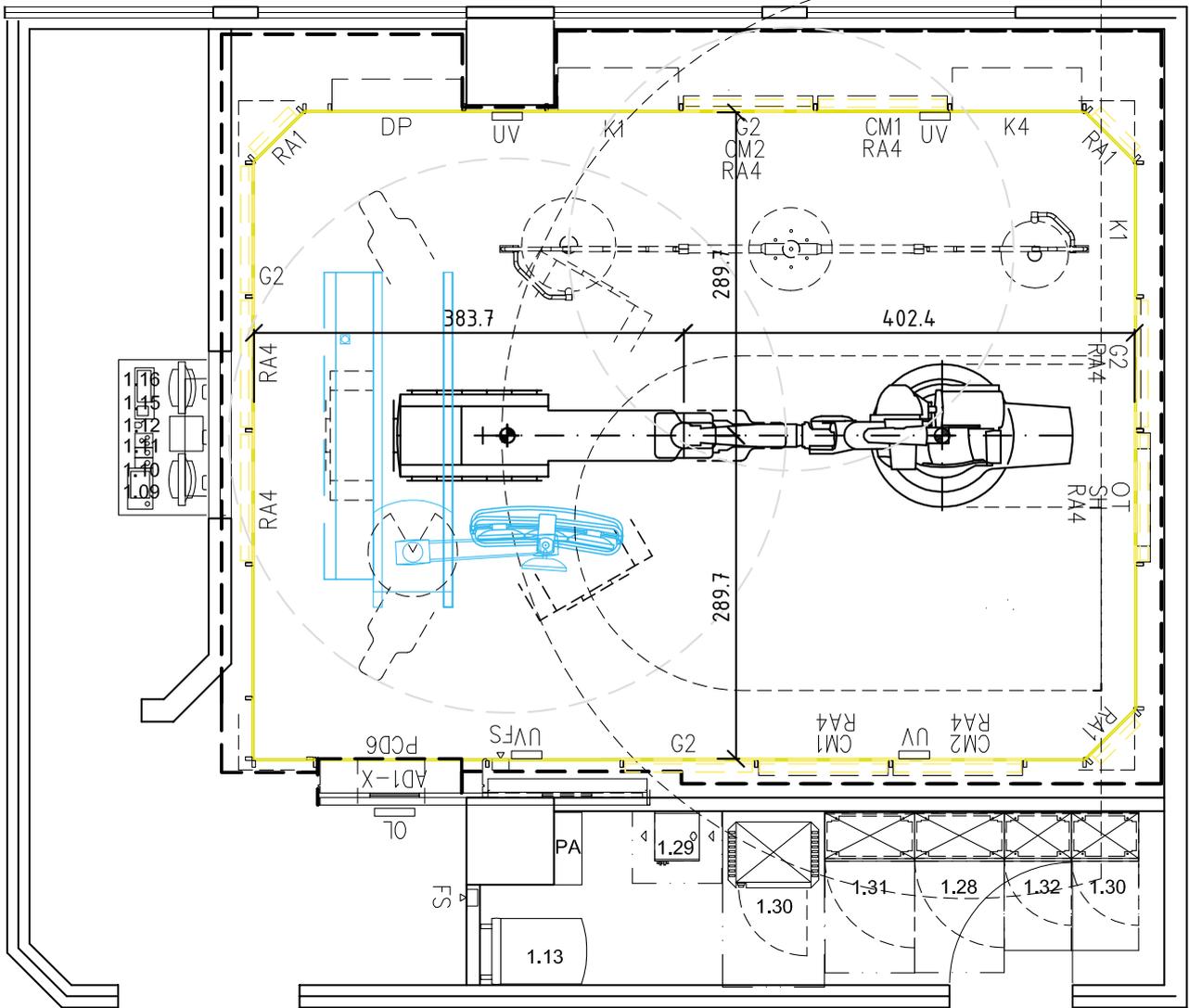
Emergency aneurysmal intraventricular hemorrhage (IVH) and subarachnoid hemorrhage (SAH)

A 57-year-old male patient was admitted to the hospital with suspected aneurysmal subarachnoid and intraventricular hemorrhages. He was transferred directly to the hybrid operating room in the neurosurgical department to ensure the fastest possible care in this critical situation.

The Hybrid Operating Room

The robotic 3D angiographic Artis zeego is installed in the neurosurgical department's hybrid operating room. The Artis zeego is fully integrated with the Artis OR table and adapts automatically to any movement of the table. The size of the room is 55 m² including storage cupboards on the walls. The hospital has chosen not to install anesthesia booms on the ceiling but instead anesthesia wall outlets to eliminate any movement restrictions for the robot. The Display Ceiling Suspensions (DCS) with six large monitors are installed at the foot of the table so that the monitors can be positioned at any side of the table. The control room provides a direct view into the hybrid operating room.





Diagnosis

After the rapid transfer of the emergency patient into the Hybrid Operating Room, an initial angiography is acquired to ascertain the patient's condition and to decide on the best treatment plan.

The angiography indicates high intracranial pressure, confirming the urgency of this case.



Conversion to open surgery

The team decides to switch to an open surgery to reduce the intracranial pressure. With a single press of a button, Artis zeego is moved directly from the surgical field to a predefined park position. This allows quick access to the patient and ensures that the imaging equipment does not restrict the staff's movement during the open surgery. The patient is prepared for the burr hole trepanations (left).

External ventricular drainages are placed in both lateral ventricles to release cerebrospinal fluid (CSF). 3D image guidance might be utilized to target the lateral ventricle accurately and safely.





Verifying pressure reduction

After placement of the ventricular drainages, Artis zeego is driven back into the surgical field (left) and a standard angiography is acquired to confirm that the intracranial pressure is actually reduced (bottom right).





3D angiography to plan further treatment

The intracranial pressure is reduced and its cause is further investigated. A high-contrast 3D syngo DynaCT is acquired by rotating the C-arm 200 degrees around the patient. The 3D images provide detailed insight into the pathology and facilitate an informed decision right in the OR.

A small aneurysm is identified, and in this case a decision is made to coil the aneurysm.

The 3D workstation in the OR provides tools for planning the endovascular procedure based on the size of the aneurysm and supports the surgeon during the procedure through advanced real-time 3D road mapping as shown next page.

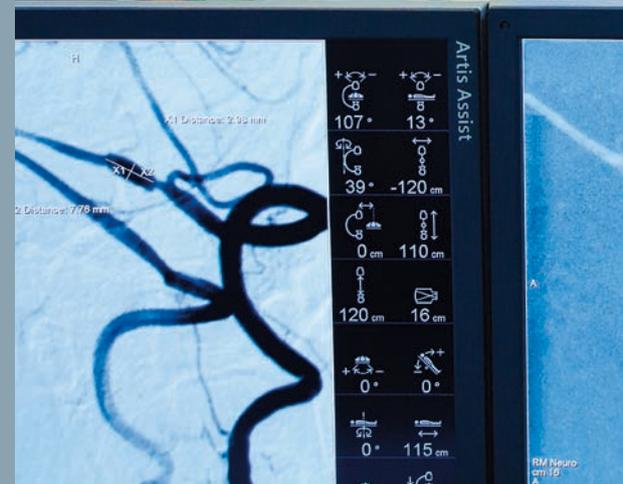




Configuration of the Hybrid Operating Room

At the Taichung Veterans General Hospital, Taiwan

- Artis zeego with Automap functionality
- Artis OR table with narrow tabletop
- syngo MMWP with syngo DynaCT and syngo InSpace 3D FlashRT, syngo iPilot, syngo 3D Basic, and syngo Angio Package
- syngo DynaCT 360
- 2k acquisition with 30x40 detector, 3D/3D card acquisition including DYNAVSION
- One monitor boom on Display Ceiling Suspensions (DCS) equipped with six 19-inch screens
- 3.20 x 3.20 m laminar air-flow field
- Two Estella OR lamps





Benefits

- High-end imaging in the OR for combined endovascular and open surgery (hybrid procedures)
- Rapid treatment of emergency patients
- Intraoperative 3D imaging for informed decision making in the OR
- Predefined park position of the imaging equipment for unrestricted access to the patient
- Large detector for extensive patient coverage



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