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[1] The 120-minute figure is based on the extensive experience of Prof. Christian Raftopoulous, MD. The clinical cases shown herein are based on results that were achieved in the customer's unique setting. Because there is no "typical" hospital or laboratory and many variables exist (e.g., hospital size, doctor's experience, samples mix, case mix, level of IT, and/or automation adoption) there can be no guarantee that other customers will achieve the same results.
[2] Takes place in the radiology department.
[3] Compared to conventional approach with pre- and postoperative CT scans located in the radiology department.

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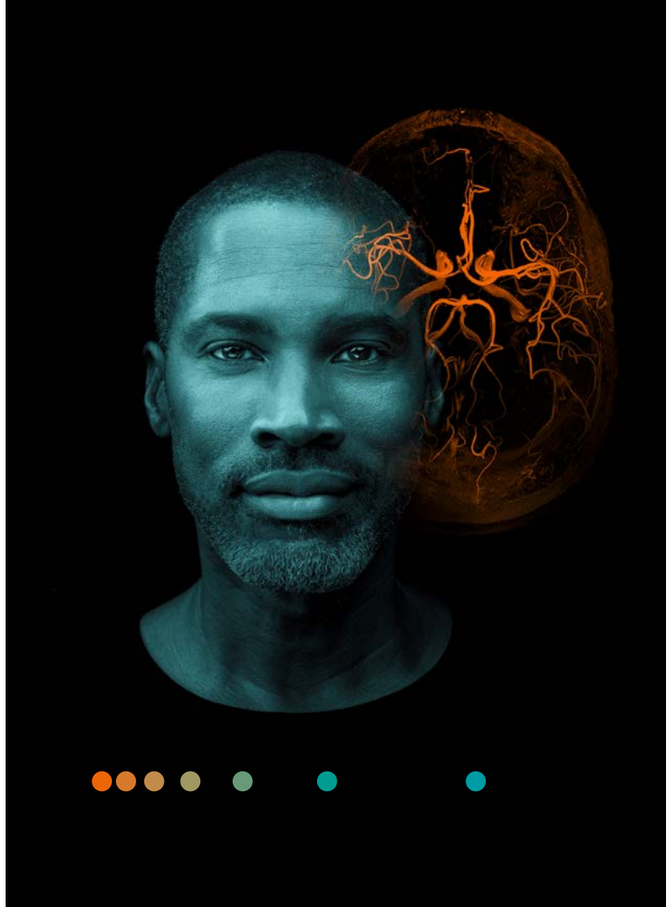


Cliniques universitaires Saint-Luc in Brussels

Save 120 min of valuable OR time[1]

Deep brain stimulation workflow with ARTIS pheno

siemens-healthineers.com/neurosurgery

SIEMENS Healthineers

Introduction

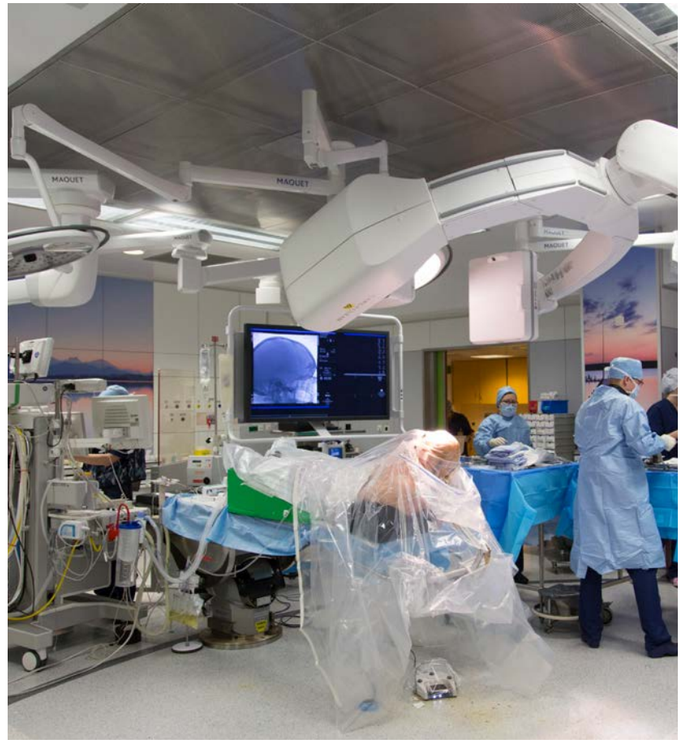
The Cliniques universitaires Saint-Luc in Brussels offers approximately 1,000 beds in a variety of specialties. Thanks to its highly specialized teams and continuous investment in state-of-the-art medical equipment, Saint-Luc is able to treat even the most complex conditions.

Prof. Christian Raftopoulos, the head of the Department of Neurosurgery at Saint-Luc's, is an international authority on neurosurgery, including deep brain stimulation, spine surgery, and neurovascular surgery.

OR setting

The Clinique universitaires Saint-Luc has two robotic C-arms and three Hybrid ORs. The newest Hybrid OR was built in 2013 and is equipped with a robotic imaging system.

- Hybrid OR: 74 m^2
- Control room
- Siemens Healthineers floor-mounted robotic C-arm
- Maquet Magnus OR table
- 2 anesthesia booms
- *syngo* X workplace
- Large display
- Laminar air flow
- *syngo* Image Fusion Package
- Intraoperative 3D imaging with *syngo* DynaCT and *syngo* DynaCT Large Volume



Procedure description

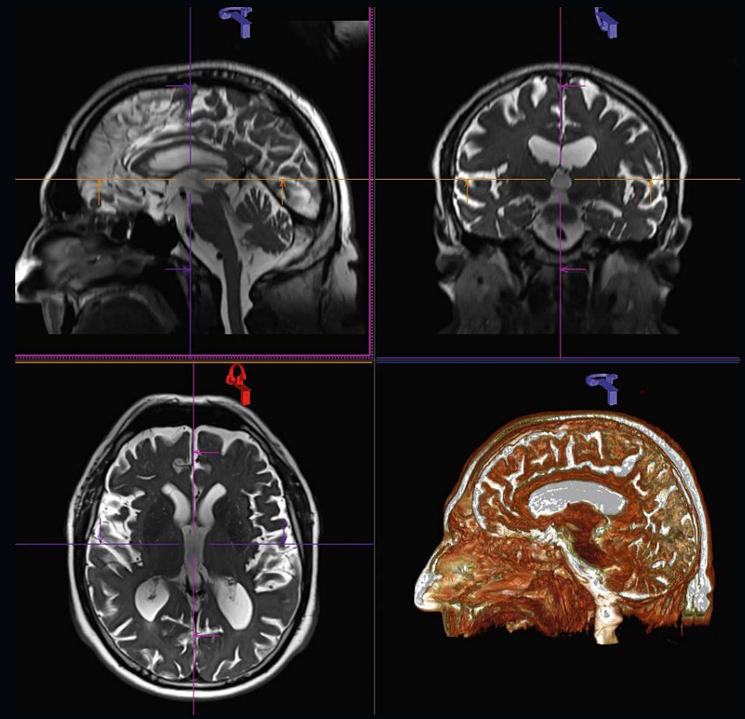
Planned procedure: Deep brain stimulation (DBS) is an elective surgical procedure to stimulate certain areas of the brain, e.g. ventral intermediate (VIM) nucleus to control seizures caused by essential tremor.

Preprocedural planning: A 3T magnetic resonance imaging (MRI) exam was performed under sedation 10 days prior to surgery to visualize the targeted nucleus and precisely evaluate brain vessels.

Step 1

Preprocedural magnetic resonance imaging

An MRI is needed to identify the targeted nucleus and is later used for intraoperative target planning.



Target visualization with preprocedural MRI images

Step 2

Patient preparation

In the Hybrid OR the patient is getting prepared for stereotactic surgery with the assistance of a three-dimensional coordinate system.

The intraoperative stereotactic frame placement is essential for precise intraoperative target guidance in the anatomic area throughout the entire procedure.

Under anesthesia, patient's head is fixed to the stereotactic four-pin fixation headring. Another localizer frame is mounted on top of the head ring for registration purposes.

To register the frame on patient's head, imaging is required to produce landmarks that are used to calculate the coordinates of the target area.

Usually, there is no head 3D scan possible in a conventional OR, therefore the patient would need to be transported to the radiology department to perform imaging.

Mounting of headring

Mounting of localizer frame

Patient preparation in the Hybrid OR

Step 3

Intraoperative 3D imaging

The robotic C-arm in the Hybrid OR allows intra-operative 3D acquisition to register the localizer frame on patient's head.

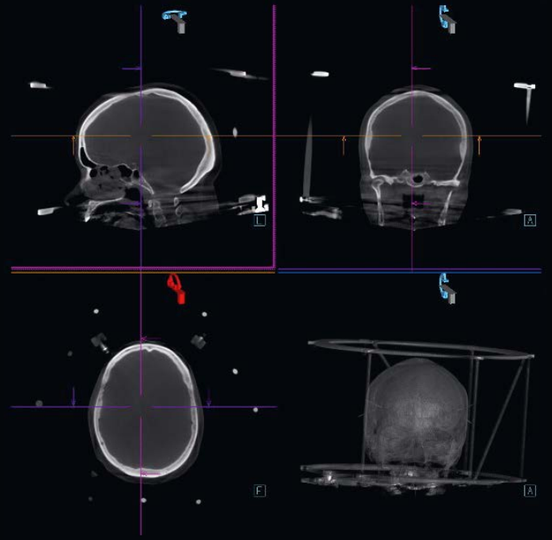
Since the 3D scan can be performed directly in the Hybrid OR with the robotic C-arm, the patient transportation to the radiology department for a brain CT scan can be eliminated.

With *syngo* DynaCT Large Volume the patient's head with the localizer frame can be acquired within a few seconds to identify vertical and diagonal rods which produce landmarks.

The 3D scan is sent to a dedicated planning software while the patient is being prepared for the procedure.

The Z-localizer has been removed and the head in the stereotactic head frame is fixed to the table with a clamp for maximum stabilization.

Hybrid OR set-up for 3D scan



syngo DynaCT Large Volume of patient's head with headframe

Patient preparation for ongoing procedure

Step 4

Trajectory planning

To create intracranial stereotactic trajectories, from entry point to target point, a dedicated planning software is used for this purpose.

For registration, alignment of the preoperative MR data set and the intraoperative *syngo* DynaCT Large Volume images with the localizer frame is needed.

The neurosurgeon uses a planning software to generate precise images of the target structures, enabling him to select the optimal approach to avoid harming any critical structure and try to prevent hemorrhages, loss of function or other complications.

After the selection of the suitable path, the software calculates and displays the xyz coordinates of the target point relative to the stereotactic frame. The coordinates can then be transferred to the stereotactic arc at the coordinate frame.

Adjustment of stereotactic arc on the basis of calculcated target coordinates

Stereotactic arc at the coordinate frame

Step 5

Introduction of electrodes

The robotic C-arm offers live image guidance during electrode implantation to complement stereotactic guidance.

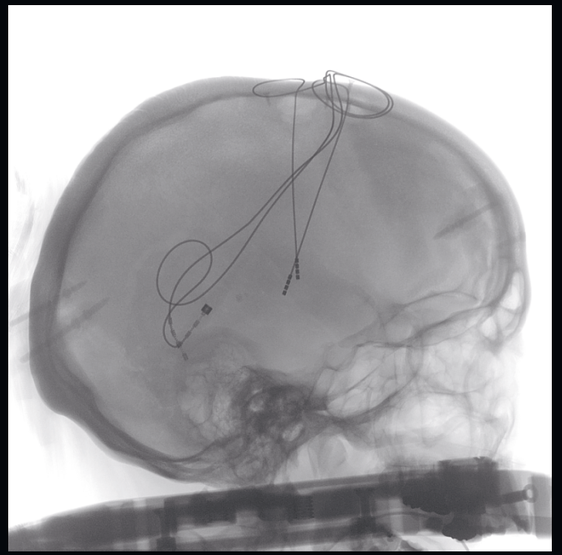
To start the procedure, the stereotactic arc is positioned on top of the headring and a dime-sized burr hole is made in the given direction. The electrodes are placed in the guide tubes and introduced into the brain.

The precise, millimetric placement of the electrodes is performed by combining the directions indicated by the coordinates transferred to the stereotactic frame with the support of robotic C-arm fluoroscopy.

The robotic C-arm moves into the surgical field in just a few seconds and recalls the previously saved position. Direct visualization of the implanted electrodes allows the team to check that the target point is as precise as planned.

Burr hole in appropriate location

Wide-space C-arm in lateral position



Intraoperative 2D fluoroscopy check of electrodes

Step 6

Intraoperative quality control with 3D imaging

The robotic C-arm allows intraoperative confirmation of the electrodes position right in the OR.

The introduction of each electrode needs to be millimetrically correct. The recommended post-operative control of precise electrode placement routinely takes place in the radiology department.

Instead, the team has significantly sped up the workflow by avoiding the extra patient transfer and performing the postoperative control in the Hybrid OR with *syngo* DynaCT Large Volume.

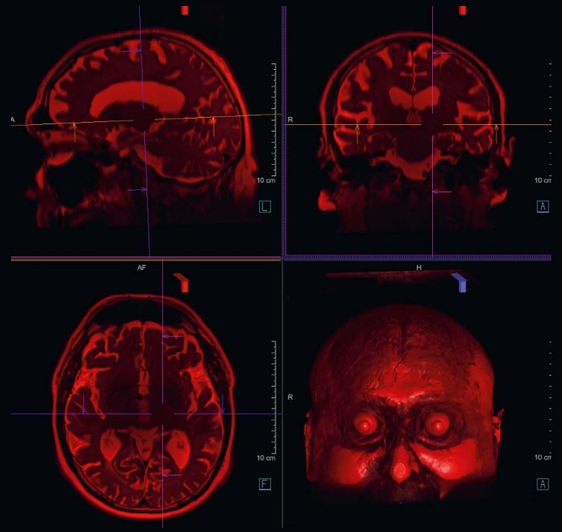
Postoperative quality control with *syngo* DynaCT in the Hybrid OR

Intraoperative 3D scan to check final electrode placement

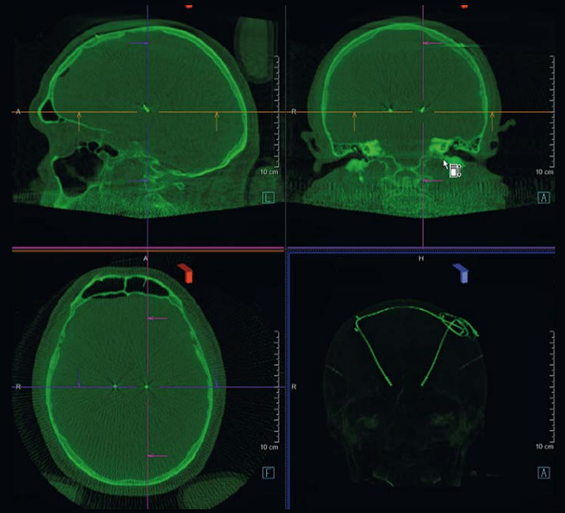
The preoperative MRI is fused intraoperatively using the *syngo* Fusion Package to immediately check the result and ensure precise positioning of the final stimulating electrodes.

The control *syngo* DynaCT without patient repositioning is acquired in just a few seconds. This native 3D fluoroscopic acquisition is then fused automatically with the preoperative MRI using the *syngo* Fusion Package to show the precise lead position.

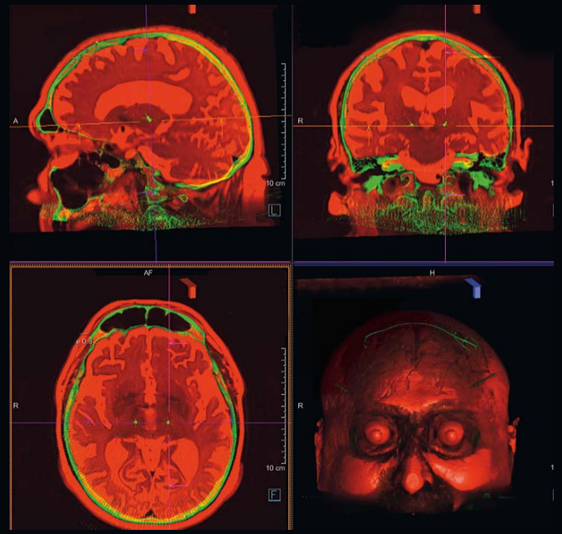
If necessary, electrodes corrections can be made immediately while the patient is still in the OR.



Preprocedural MRI scan

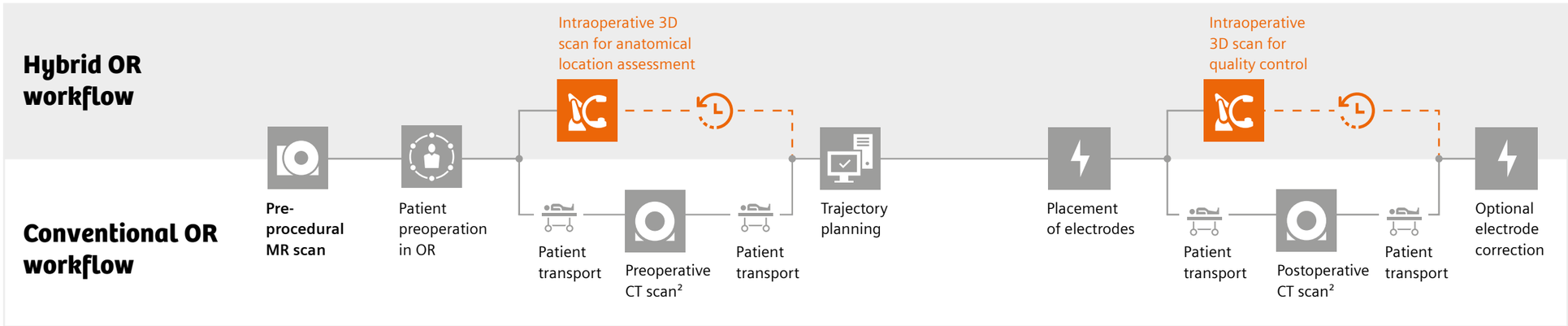


Postoperative *syngo* DynaCT scan



syngo DynaCT Fusion image

Comparison of workflows



Customer experience shows the feasibility to

save 120 minutes[1]

in the Hybrid OR workflow for deep brain stimulation by eliminating the pre- and postoperative CT scan.

Higher utilization increases the efficiency of the Hybrid OR

Prof. Christian Raftopoulos,
Head of Neurosurgery,
Cliniques universitaires Saint-Luc,
Brussels, Belgium

"We're performing a total of two intraoperative 3D scans with the robotic C-arm: one before and one after implantation. This system allows us to save valuable procedural time of two hours that gives us the possibility to perform a second surgery in the same OR after the DBS procedure. This makes our department highly productive.

The main benefit for the patients is the reduced risk of complications and infections by eliminating the need to transport the patient to the radiology department. Reducing the overall procedure time is always the best for the patients."[1]

System information

The Artis zeego used in this workflow is no longer available and has been replaced by ARTIS pheno. For more information, please see siemens-healthineers.com/artis-pheno or contact your local sales representative.

Benefits of the robotic C-arm in the Hybrid OR

1. Precise targeting and automatic image fusion using preoperative MRI and *syngo* DynaCT with *syngo* Fusion Package
2. 3D imaging with *syngo* DynaCT LargeVolume for trajectory planning and quality control may contribute to increased procedural success[3]
3. Potentially reduced patient transfer and anesthesia time
4. Financial benefits for the hospital thanks to optimized resources and greater utilization of the Hybrid OR

Want to know more?

For more information on our workflows, products, and solutions, please scan the adjacent QR code or visit siemens-healthineers.com/neurosurgery