

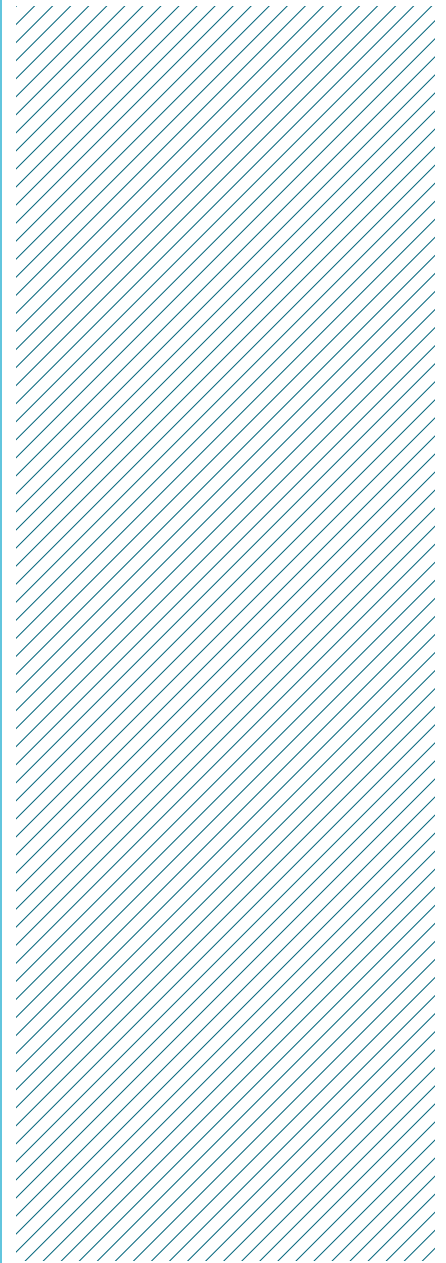
Customer Perspective

Leksell® Vantage™ Stereotactic System provides advantages for stereoelectroencephalography (SEEG)

Contributor

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About

Ruber International Hospital

Offering a wide range of medical disciplines and specialties, Madrid's Ruber International Hospital is among Spain's leading private healthcare facilities. The hospital's Department of Functional Neurosurgery and Radiosurgery has considerable expertise and is equipped with state-of-the-art technologies for the diagnosis and treatment of a wide range of neurological disorders.



Dr. Roberto Martínez Álvarez
Head of Functional Neurosurgery
and Radiosurgery



Background

Stereoencephalography (SEEG) is available at Ruber International Hospital for the treatment of patients with drug-resistant focal epilepsy. This procedure involves the implantation of multiple electrodes in the subdural part of the brain using a stereotactic technique. The electrodes are used to record signals during an epileptic seizure and to locate the epileptic focus, which can then be resected or ablated.

“The implantation of electrodes in the brain for stereoencephalography is increasingly popular in the neurological world,” explains Dr. Roberto Martínez Alvarez, the hospital’s Head of Functional Neurosurgery and Radiosurgery. “It allows the epileptic focus to be located much more accurately by directly recording signals in the cerebral cortex. In addition, neurologists can stimulate the cortex to emulate a seizure. In recent years, it has also been possible to take advantage of the implanted SEEG electrodes to ablate the epileptic focus to reduce or eliminate seizures.”

SEEG electrodes may be implanted into a wide range of targets in the brain, including the temporal, frontal and insular lobes. Stereotactic planning software is used to define the trajectories required to avoid ventricles, sulci and blood vessels. Extreme precision is vital for placing the electrodes, and lateral entry points are often chosen to avoid passing through critical structures.

Since 2010, over 80 patients have been treated using SEEG at Ruber International Hospital, involving the implantation of more than 900 SEEG electrodes. Previously, SEEG electrodes were implanted using Leksell Stereotactic System®, renowned for its ease of use, high accuracy and precision for stereotactic neurosurgery. In November 2017, the department began to use the Leksell® Vantage™ Stereotactic System for its stereotactic procedures.

Leksell Vantage Stereotactic System

Leksell Vantage Stereotactic System builds on the strong principles and foundations of Leksell Stereotactic System to provide neurosurgeons with a high level of user confidence in an intuitive and user-friendly workflow. Leksell Vantage Stereotactic System is manufactured using innovative materials to meet the demands of modern imaging techniques, and the open-face design ensures a greatly improved patient experience (Figure 1).

“The construction of the arc in Leksell Vantage Stereotactic System is more robust, allowing even greater accuracy,” Dr. Martínez says. “At the same time, the lightweight frame is more comfortable for the patient and the open-face design allows improved access for anesthesia. The patient can be intubated with the frame placed in any position, without any problems.”



Figure 1. Leksell Vantage Stereotactic System is based on the proven Leksell coordinate system and center-of-arc principle. Innovative materials, an open-face design, and ease of use are making it a new favorite among stereotactic neurosurgeons.

Greater flexibility for SEEG electrode implantation

“With the previous system, I found I had to change the orientation of the arc to implant SEEG electrodes at certain positions,” reports Dr. Martinez.

“Leksell Vantage Stereotactic System allows me to make lateral paths through the arc ring and at an oblique angle, with a limitation of about 10 degrees in each direction due to the rings.”

With Leksell Stereotactic System, it was common practice to position the stereotactic arc in an anterior-posterior orientation to maximize accessibility to lateral entry points. By contrast, Leksell Vantage Stereotactic System is designed

to allow for lateral trajectories with the arc in its standard orientation (lateral right or lateral left). This is possible because the stereotactic arc angles have been increased from 0–170 degrees to 0–184 degrees, which increases flexibility for lateral implants by allowing surgery to be performed through the ring of the stereotactic arc on both hemispheres (Figure 2).

When using Leksell Vantage Stereotactic System in SEEG, some lateral arc angles will be blocked by the rings on either side of the frame. Which arc angles are blocked depends on the chosen x-coordinate and the diameter of the surgical instrument. When an entry point results in a blocked arc angle, it must be changed in the planning software to obtain a different arc angle. Specific blocked arc angles are presented in Table 1.

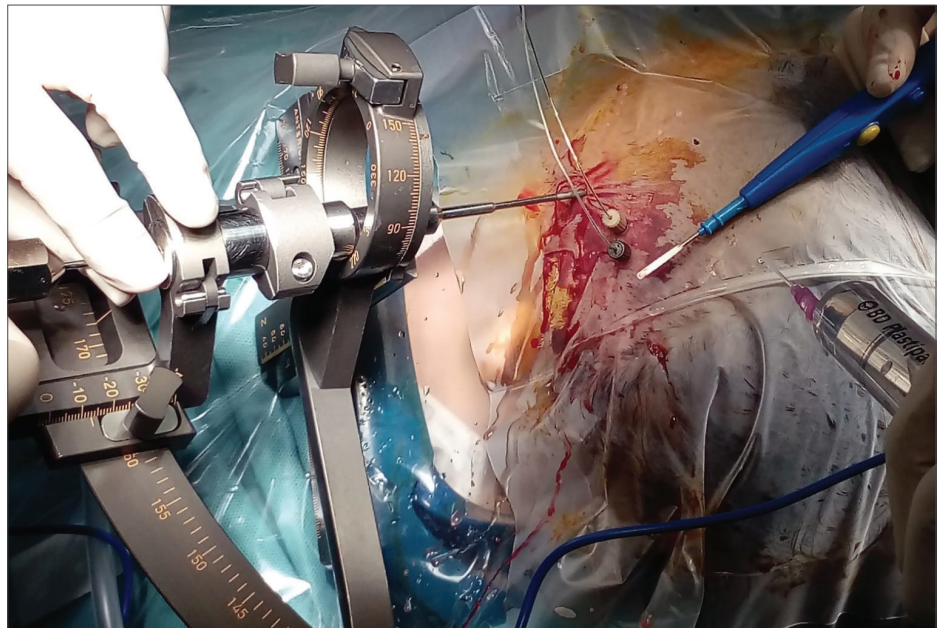


Figure 2. Leksell Vantage Stereotactic System is designed to enable lateral trajectories through the rings.

Table 1. Blocked angles when using AdTech drill guide (external diameter of 6.3 mm) together with Leksell Vantage Stereotactic System. Arc is positioned in lateral right orientation.

| X-coordinates (mm) | Blocked arc angles (degrees) | | Total range (degrees) |
|--------------------|------------------------------|-------------|-----------------------|
| | Left | Right | |
| 50 | 12.5–24.0 | - | 11.5 |
| 60 | 11.5–21.5 | - | 10 |
| 70 | 10.5–19.0 | - | 8.5 |
| 80 | 9.5–17.5 | - | 8 |
| 90 | 9.0–16.0 | - | 7 |
| 100 | 8.0–15.0 | 165.0–172.0 | 7 |
| 110 | - | 164.0–171.0 | 7 |
| 120 | - | 162.5–170.5 | 8 |
| 130 | - | 161.0–169.5 | 8.5 |
| 140 | - | 158.5–168.5 | 10 |
| 150 | - | 156.0–167.5 | 11.5 |

Enhanced MR imaging

The non-metallic head frame and accessories of the Leksell Vantage Stereotactic System enable faster frame-based MR imaging and allow clinicians to see more clinically relevant anatomy and vasculature without distortions in the acquired images.

“I have now performed over 30 electrode implantations for SEEG using the Leksell Vantage System,” comments Dr. Martínez. “I have been able to place the electrodes in all required positions and the process is somewhat faster than with the old G frame. The biggest difference that I have found is that the accuracy has been 25% higher, on average, since the MRI calculations are more accurate and reliable. MRI examinations are much improved with the Leksell Vantage Stereotactic System because the new frame does not cause distortions—there are no artifacts relating to the fixing screws. We are able to use MR sequences that are more effective and were not possible with the G frame.”

“It is also important to point out that we only need to perform MRI in stereotactic conditions with the Leksell Vantage System,” he adds. “It is not necessary to obtain a CT scan or to perform co-registration, as required with other systems.”

A smooth clinical workflow

With fewer parts to assemble and a rapid, click-on docking mechanism, patient setup is much easier and faster with the Leksell Vantage Stereotactic System. The new design places the X-, Y- and Z-scales outside of the draping, which enables smooth and easy coordinate setting during surgical procedures.

“The transition to the Vantage Stereotactic System was very easy,” says Dr Martínez. “The system is very intuitive and easy to use. I have trained three neurosurgeons in how to use the Vantage system and they can manage it after two operations.”

“Frame fixation is easier, too,” he continues. “A band is used to easily adjust the frame to the patient’s head. The screws have five different lengths, and you quickly learn how to measure the distance between the frame and the skin. The screws are also easy to apply.”

“Fixing the Vantage System to the MRI antenna is different compared to our previous frame, but it is easily learned in just a few supervised procedures for a neurosurgeon without prior knowledge,” he adds.

The procedure for SEEG electrode implantation at Ruber International Hospital is as follows:

- Treatment planning is performed on the patient’s previous MRI scan, using in-house software for SEEG surgery (Neuroplanner).
- The Leksell Vantage frame is fixed to the patient’s head.
- MRI is performed with the Leksell Vantage frame in stereotactic conditions (fiducial box attached). This includes a vascular study with a Toft (time of flight) sequence developed at Ruber International Hospital.
- The required trajectories are planned using Leksell SurgiPlan® software.
- The patient is transferred to the operating room and undergoes general anesthesia.
- The frame is fixed to the operating table.
- The entry points are located and the implantations are performed by means of perforations in the skull. The SEEG electrodes are introduced and fixed.
- Once the surgery is completed, the frame is removed before waking the patient.
- A CT scan is performed to verify the absence of complications and the accurate placement of the electrodes.



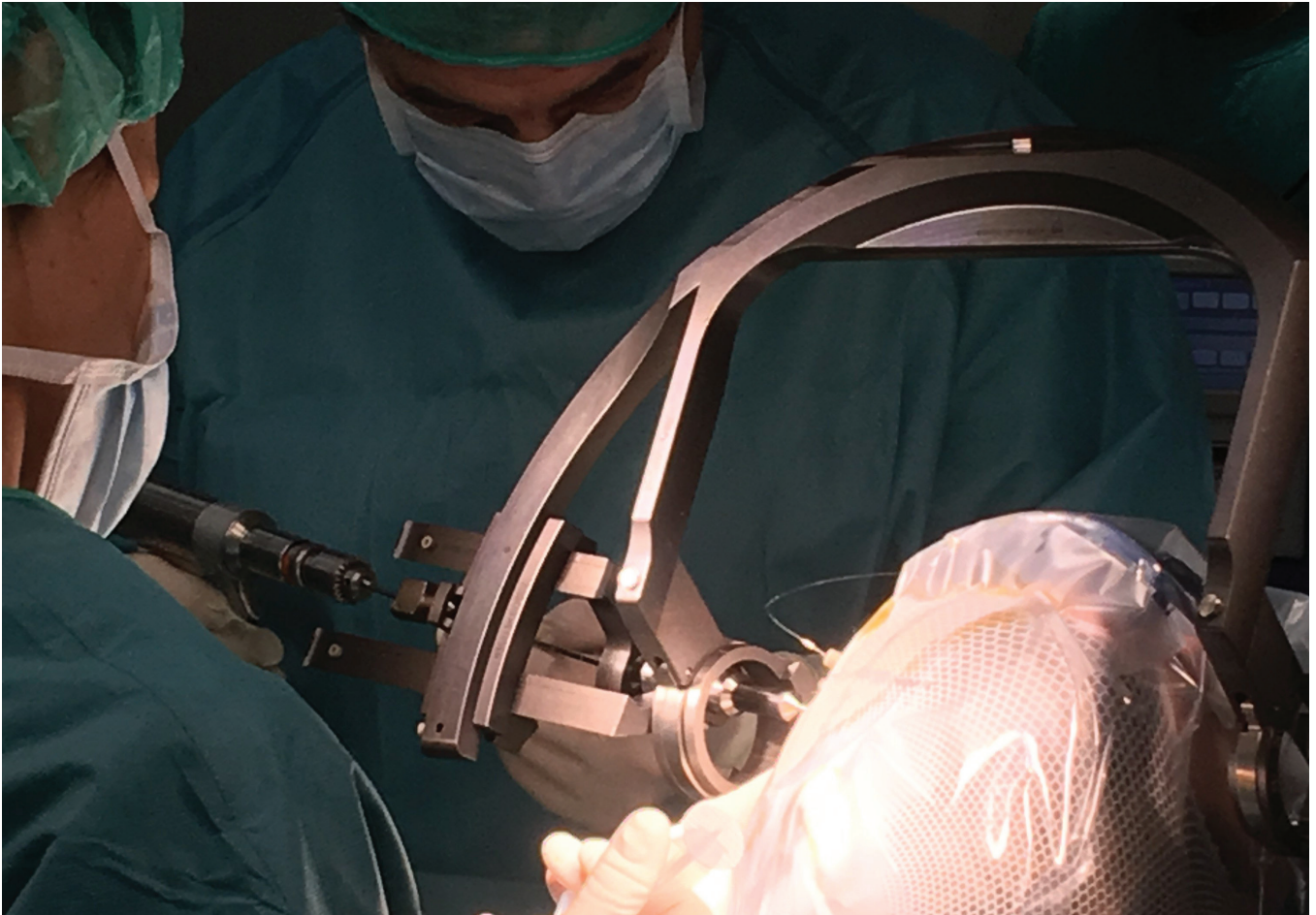


Figure 3.
Dr. Martínez performs SEEG surgery using Leksell Vantage Stereotactic System.

Case Example

A 23-year-old female patient with drug-resistant epilepsy was referred. The patient had undergone two previous SEEG procedures without results.

With the Leksell Vantage Stereotactic System, enhanced visibility of the target areas can be achieved so it is possible to enter very vascularized areas of the brain that were previously discarded. For this patient, a study of the epileptic focus was required at the frontal, parietal and occipital levels. This was particularly challenging because of the need to avoid damaging the cerebral vessels when introducing the electrodes. With the Vantage System, it was possible to perform MRI Toft sequences with greater resolution, allowing the team to better locate and see the vessels.

Eleven electrodes were implanted in different parts of the brain with extreme precision. The procedure was performed under general anesthesia from the beginning and the Vantage System was very useful

in allowing the patient to be managed in this way. After investigation, the focus was recorded in the rear quadrant of the right hemisphere. The neurologists were able to make a thermocoagulation of the epileptic focus through the implanted electrodes. The patient recovered well and is now seizure-free following this SEEG procedure (Figure 3).

“For this patient, MRI was faster and more effective with Leksell Vantage Stereotactic System,” comments Dr. Martínez. “We were able to perform a very complete stereotactic angio-MRI for a more effective study of the epileptic focus.”

“Patient management was also easier,” he continues. “The frame is lighter and can be better mobilized compared to our previous system. Access to the airway for anesthesia is also easier, which was important for this patient. Intubation would have been difficult without the Vantage System.”



Conclusions

Dr. Martínez has worked with Elekta products for over 28 years and is experienced in using the Leksell Gamma Knife® and the Leksell® Neuro Generator, as well as the Leksell Stereotactic System and Leksell Vantage Stereotactic System.

“I know I can trust Elekta after many years of using their products,” he says. “Their technical support is excellent.

“I am very satisfied with the Leksell Vantage Stereotactic System,” Dr. Martínez concludes.

“The frame is very stable and is fitted on the patient’s head easily and comfortably. The stereotactic accuracy of the Leksell Vantage Stereotactic System is less than 0.4 mm for the location of targets using MRI, and there is no distortion in the images. In my experience, it has enhanced stereotactic procedures. The number of hemorrhagic complications we experienced with the G frame was about 5% of cases. With the Vantage System this has been reduced to 1% of cases.”

Disclaimer

This customer perspective is based on the experience and application of medical experts, and is intended as an illustration of an innovative use of Elekta solutions. It is not intended to promote or exclude any particular treatment approach to the management of a condition. Any such approach should be determined by a qualified medical practitioner.

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