ExcelsiusGPS

- Advancing spine surgery: Evaluating the potential for full robotic automation
- Robotic pedicle screw placement for minimal invasive thoracolumbar spine surgery: a technical note
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Rodríguez Domínguez et al. describe the technical aspects and the different workflows available with the ExcelsiusGPS® robotic navigation system (GlobusMedical, Inc, Audubon, PA, USA), as well as the results of the first 40 patients operated on at the Hospital Universitario la Paz between July 2023 and February 2024.

Results: A total of 250 screws were implanted at the thoracic and lumbar levels. 12 patients underwent minimally invasive surgery (MIS) (30%) and 28 patients underwent open surgery (70%). The median number of screws implanted per patient was 6.00 (4.00-6.00). The intraoperative malpositioning rate was 2.5% (1 case). The median duration of surgery was 143.00 minutes (113.00-165.50). The median hospital stay was 4.00 days (3.00-5.50). The median intraoperative radiation delivered was 899 mGy/cm² (523.25-1595.00). The median blood loss was 150.00 ml (100.00-300.00) and the blood transfusion rate was 0%.

Discussion: Compared to conventional techniques, Robotic spine surgery increases accuracy to 96-100% and reduces the radiation dose received by the patient and surgical team. In addition, it allows the implantation of larger screws, which has been associated with increased biomechanical strength and reduced risk of loosening. Initially, it may involve an increase in total surgical time, but this is reduced once the learning curve is reached, around 40 cases.

ExcelsiusGPS® is the most recent robot model on the market and different studies have demonstrated its effectiveness in different techniques and indications. Unlike other robotic systems used exclusively in dorsolumbar spine pathology, it can be used in the pathology of the entire spinal axis (from C1 to the sacrum) and brain pathology (deep electrode implantation, brain biopsy, SEEG, among others) [1)].

The reported outcomes at Hospital Universitario La Paz highlight the system's potential and challenges during its introductory phase:

Accuracy and Safety:

An intraoperative malpositioning rate of 2.5% (1 case) aligns with published accuracy rates of 96–100% for robotic systems, reflecting high reliability even during the initial learning curve.
Operative Efficiency:

A median operative time of 143 minutes (113–165.5) is expected to decrease with further experience, as literature suggests a reduction in time after 40 cases. Radiation Exposure:

A median radiation dose of 899 mGy/cm² reflects the optimization provided by robotic guidance. Although relatively high compared to non-robotic systems, it remains within acceptable safety parameters for advanced imaging-assisted surgeries. Blood Loss and Transfusions:

Median blood loss of 150 ml (100–300 ml) and a 0% transfusion rate underscore the precision and minimally invasive potential of the system, reducing complications associated with conventional open surgery. Hospital Stay:

A median stay of 4 days (3–5.5) aligns with expectations for complex spine surgeries, suggesting that robotic assistance does not prolong recovery times. Discussion: Advantages and Challenges Advantages: Improved Accuracy:

Robotic assistance enhances the precision of pedicle screw placement, reducing rates of screw misplacement and revision surgeries. Biomechanical Benefits:

The system allows the implantation of larger screws, enhancing biomechanical strength and lowering the risk of implant loosening. Learning Curve:

Although the system initially increases operative times, these decrease significantly after approximately 40 cases, as demonstrated by the team's outcomes. Versatility:

The ability to address the full spinal axis and certain cranial procedures distinguishes ExcelsiusGPS® from competitors, broadening its clinical applicability. Reduced Radiation:

Radiation exposure for both patient and staff is significantly lower than in traditional fluoroscopy-guided techniques, enhancing occupational safety. Challenges: Cost and Accessibility:

Robotic systems involve substantial investment and ongoing costs for maintenance and training, potentially limiting their adoption in resource-constrained settings. Steep Learning Curve:

The initial cases may involve longer operative times and a risk of technical errors, underscoring the importance of thorough training and mentorship. Intraoperative Adaptability:

Robotic systems may struggle to adapt to unanticipated anatomical variations or complications, requiring surgeons to maintain expertise in conventional techniques as a backup. Conclusion The introduction of the ExcelsiusGPS® at Hospital Universitario La Paz demonstrates the promising potential of robotic-assisted spine surgery. With high accuracy, reduced radiation, and enhanced biomechanical outcomes, the system offers clear advantages over traditional methods. However, its utility is tempered by cost considerations and a significant learning curve. Continued refinement of workflows and broader adoption across diverse clinical settings will likely confirm its role as a cornerstone technology in modern spine surgery.

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Rodríguez Domínguez V, Bedia Cadelo J, Giner García J, Gandía González ML, Vivancos Sánchez C, Isla Guerrero A. Robotic spine surgery: Technical note and descriptive analysis of the first 40 cases. Neurocirugia (Astur : Engl Ed). 2024 Dec 12:S2529-8496(24)00080-7. doi: 10.1016/j.neucie.2024.12.002. Epub ahead of print. PMID: 39674279.