VRiMS Virtual Reality in Medicine and Surgery

Integrating Mixed Reality Navigation in Spine Surgery: Experience from a National Spinal Injuries Unit and Logistical-Economic Analysis

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ABSTRACT

Introduction: Mixed Reality (MR) navigation overlays three-dimensional anatomical reconstructions into the surgeon's operative field. This study presents a case series describing the clinical application, workflow integration, and logisticaleconomic considerations of the Brainlab Spine MR Navigation System in spinal surgery.

Methods: A retrospective review was performed using data from all spinal procedures completed with the Brainlab MR navigation platform between September 2024 and March 2025. Fifteen patients underwent posterior procedures, including trauma, degenerative, oncologic, and deformity cases. Operative approach, levels fused, use of minimally invasive techniques, setup time, and intraoperative workflow integration were documented. Postoperative imaging was reviewed for hardware placement and alignment.

Results: MR was implemented in six trauma, five degenerative, three oncologic, and one deformity case. Four procedures (27%) used percutaneous techniques. The mean number of levels fused was 2.9 (range 1–8). The MR system added approximately 3–5 minutes for registration, with headset re-registration required in three cases, resolved without significant delay. No intraoperative complications were attributable to MR use. Postoperative imaging confirmed correct hardware positioning and satisfactory alignment in all patients. Surgeons reported benefit in percutaneous stabilisations and tumour resections from continuous 3D overlays. The 3-year cost for a dual-headset system was €59,660 with no ongoing per-case consumable costs.

Conclusions: This study demonstrates the feasibility and safety of MR navigation in posterior spinal procedures. The system integrates efficiently into existing workflows, enhances spatial awareness, and may offer particular value in minimally invasive and tumour cases. Further prospective studies are required to assess outcomes, cost-effectiveness, and broader adoption potential.

Keywords: Mixed reality spine navigation, Posterior spinal instrumentation, Brainlab navigation system, Intraoperative 3d overlay workflow, Logistical-economic analysis