

**Introduction:** Stereotactic radiosurgery (SRS) requires exceptional spatial accuracy due to the delivery of a high radiation dose in a single session. In intracranial stereotactic radiosurgery, a treatment plan is developed directly based on magnetic resonance imaging data. Thus, any geometric distortion of the images directly leads to an error in dose delivery, which can lead to an underdose of the target and an overdose of neighboring healthy structures. Regular quantitative quality control of distortion is essential but often remains a non-standardized procedure in clinical practice. In our department, MRI distortion assessment is performed using the Elekta phantom, but in the absence of dedicated evaluation software, the procedure remains time-consuming and largely subjective. In this study, we are implementing software for standardized evaluation of the geometric accuracy of MRI scanners in a clinical center.

**Results:** The analysis showed that the average spatial displacement on all tested MRI scanners remained below 0.35 mm, which is a good indicator of accuracy. Consistent with theoretical expectations, maximal local distortions - reaching up to 2.75 mm - were systematically detected at the periphery of the visual field, while minimal displacements were observed at the image isocenter. Of the four scanners, scanner No. 2 demonstrated the best geometric accuracy with the lowest average and maximum offset of 0.35 and 0.93 mm respectively, which makes it the most reliable device for high-precision planning.

**Materials and Methods:** A single-center study was conducted using four clinical MRI scanners at the Burdenko Institute of Neurosurgery, all of which can potentially be used to acquire topographic images for stereotactic radiotherapy planning. A stereotactic MRI phantom (Elekta) was scanned on each MRI scanner and additionally on a CT scanner. Geometric distortions were assessed by quantifying the spatial deviations between the positions of the reference markers (thin phantom rods) on the MRI images and their reference positions on the CT image. Image registration and automatic calculation of three-dimensional displacement vectors for each marker were performed using the ScanCheckup software, developed in-house at the National Research Nuclear University MEPhI, by comparing each marker's location in the MRI datasets with the CT reference dataset and generating detailed spatial error maps.

**Conclusion:** Geometric distortions were successfully evaluated using the in-house developed ScanCheckup software, which demonstrated that the geometric accuracy of the MRI scanners at the Burdenko Institute is within clinical tolerances (average error < 0.35 mm). ScanCheckup proved to be a convenient and efficient tool for comprehensive spatial distortion assessment, enabling rapid and objective analysis using the Elekta phantom. The results confirm the potential suitability of these scanners for SRS planning. The developed methodology is essential for the routine quality control of MRI systems within the SRS workflow, ultimately improving treatment safety and effectiveness by reducing the risks associated with spatial inaccuracies in imaging data.

