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Stereotactic Robotic Application Accuracy Is Very High in 'in vivo' Procedures

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I read with great interest the paper by Lefranc et al. [1], highlighting that 'the ROSA stereotactic robot improves the accuracy of stereotactic surgery'. The authors reported on the results of a series of phantom experiments, assessing the importance of imaging modality and registration methods for the final application accuracy. Moreover, they retrospectively measured the localization error at the entry point or at the target point in a number of surgical procedures aimed at performing biopsies or deep brain stimulation implantations. The results of the study are excellent, both on phantom and on in vivo procedures. The latter are surely more important, because the overall accuracy of a system could be significantly worsened by patient-related factors, such as the weight-bearing effect, despite excellent intrinsic accuracy of the robot.

Surprisingly, the authors ignored in their discussion the largest series reporting the in vivo application accuracy of a stereotactic robotic system. In fact, we published in 2013 a study [2] on 500 stereoelectroencephalography (SEEG) procedures, including a study of the localization error (LE) in a series of 1,050 frame-based electrode implantations assisted by the Neuromate robotic system (Renishaw-Mayfield). We assessed the LE on both the cortical entry point and the deep target point. Because the SEEG electrodes are semirigid and are implanted without any guide tubes, the target point LE, even if excellent (median error = 1.77 mm, interquartile range = 1.25–2.51 mm), can be certainly affected by slight intra-

cranial deviations. In order to verify the intrinsic accuracy of the stereotactic system, it is therefore advisable to consider the entry point LE as the most important measure. We obtained a median LE of 0.78 mm, with an interquartile range of 0.49–1.08 mm. This result is almost identical to the accuracy reported by Lefranc et al. in 52 frame-based implantations performed in vivo (mean 0.81 mm, SD 0.39 mm). It can also be stressed that we similarly used cone beam computed tomography obtained with the O-arm system (Medtronic) as the reference data set, thus making the data highly comparable. Comparing contemporary studies shows similar accuracies between the two robotic systems. Although the authors point out the earlier development of the Neuromate system, this system has been under continuous development, and this is unlikely a significant difference between the systems. We have used the Neuromate since 2001, and our measures were collected in the period 2008–2011, after the robot had been in use for many years. Despite the old age of the system, the results were optimal.

In conclusion, robotic devices are highly accurate and can efficiently assist the surgeon in stereotactic procedures such as SEEG, biopsies and deep brain stimulation.

Disclosure Statement

Dr. Cardinale reports receiving consulting fees from Renishaw-Mayfield since 2010.

References

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