Eliciting smile and laughter during intraoperative electrical stimulation of the cingulum: Surgical scenario

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TITLE PAGE

TITLE OF THE PAPER

Eliciting smile and laughter during intraoperative electrical stimulation of the cingulum: Surgical scenario

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**KEYWORDS**

Astrocytoma; awake craniotomy; cingulum; intraoperative electrical stimulation; laughter

**SHORT TITLE**

The cingulum and laughter

**OTHERS**

**Patient consent:** The patient gave informed consent to the procedure and signed the consent to publication of materials (videos, images or another clinical or genetic information) in journals. These informed consents were approved by the Institutional Review Board (Comité de Ética de la Investigación con Medicamentos de Cantabria, IDIVAL).

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ABSTRACT

Laughter has a major role in daily life social interactions and consequently, its biological bases have been previously studied. Nevertheless, its cerebral representation remains unclear. The most accepted hypothesis has postulated that laughter has two components: the mirth, related with the temporal and frontal neocortical areas, and the motor aspect, related with the limbic system and brainstem. Furthermore, in prior studies, laughter has been elicited during electrical stimulation with depth electrodes in the supplementary motor area and the cingulum.

The present video reports a right superior frontal gyrus diffuse astrocytoma (IDH mutant, WHO grade II) resection with awake intraoperative electrical cortical and subcortical stimulation mapping. A DTI-tractography, including all the tracts in relation with the tumor, was obtained pre- and postoperatively. The stimulation of the cingulum located medially and inferiorly to the tumor, elicited a patient’s smile and laugh without mirth or merriment. Besides, this point correlated with the reconstructed cingulum in the intraoperatively navigated DTI-tractography.

In conclusion, the present findings support the anatomic subdivision of the laughter’s mechanism and the role of the cingulum in its motor component. Furthermore, smile and laughter could be useful functional landmarks to identify the cingulum during subcortical mapping. Although it remains unclear if pursuing the resection beyond this point would have caused permanent postoperative deficits, considering laughter’s role in social interaction and other emotion-processing functions associated with the cingulum, in the future it could be potentially considered as a functional limit of the resections of intrinsic tumors.

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ABBREVIATIONS

DTI-tractography: Diffusion Tensor Imaging-tractography

ROI: region-of-interest
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