Cerebello-cortical stimulation

Cerebellar mutism can occur in a third of children undergoing cerebellar resections. Recent evidence proposes it may arise from uni- or bilateral damage of cerebellar efferents to the cortex along the dentatothalamic tract. At present, no neurophysiological procedure is available to monitor this pathway intraoperatively. Giampiccolo et al. specifically aimed at filling this gap.

They assessed 10 patients undergoing posterior fossa surgery using a conditioning-test stimulus paradigm. Electrical conditioning stimuli (cStim) were delivered to the exposed cerebellar cortex at interstimulus intervals (ISIs) of 8-24 ms prior to transcranial electric stimulation of the motor cortex, which served as test stimulus (tStim). The variation of motor-evoked potentials (MEP) to cStim + tStim compared with tStim alone was taken as a measure of cerebello-cortical connectivity.

cStim alone did not produce any MEP. cStim preceding tStim produced a significant inhibition at 8 ms ($p < 0.0001$) compared with other ISIs when applied to the lobules IV-V-VI in the anterior cerebellum and the lobule VIIB in the posterior cerebellum. Mixed-effects of decrease and increase in MEP amplitude were observed in these areas for longer ISIs.

The inhibition exerted by cStim at 8 ms on the motor cortex excitability is likely to be the product of activity along the cerebello-dento-thalamo-cortical pathway. They showed that monitoring efferent cerebellar pathways to the motor cortex is feasible in intraoperative settings. This study has promising implications for pediatric posterior fossa surgery with the aim to preserve the cerebello-cortical pathways and thus prevent cerebellar mutism [1].

1)
Giampiccolo D, Basaldella F, Badari A, Squintani GM, Cattaneo L, Sala F. Feasibility of cerebello-cortical stimulation for intraoperative neurophysiological monitoring of cerebellar mutism. Childs Nerv Syst. 2021 Apr 9. doi: 10.1007/s00381-021-05126-7. Epub ahead of print. PMID: 33835202.