Subcortical

Below the cerebral cortex are a variety of other structures, called subcortical (literally “below the cortex”) structures.

Extensive descriptions exist on cortical responses to change in the acoustic environment. However, the involvement of subcortical regions is not well understood.

Beck et al. present simultaneous recordings of cortical and subcortical event-related potentials (ERPs) to different pure tones in patients undergoing surgery for deep brain stimulation (DBS). These patients had externalized electrodes in the subthalamic nucleus (STN), the lateral ventral posterolateral nucleus (VLp) or the globus pallidus internus (GPi). Subcortical and cortical ERPs were analyzed upon presentation of one frequent non-target stimulus and two infrequent stimuli, either being a target or a distractor stimulus. The results revealed that amplitudes of scalp-recorded P3 and subcortical late attention-modulated responses (AMR) were largest upon presentation of target stimuli compared with distractor stimuli. This suggests that thalamic and basal ganglia regions are sensitive to behaviorally relevant auditory events. Comparison of the subcortical structures showed that responses in VLp have shorter latency than in GPi and STN. Further, the subcortical responses in VLp and STN emerged significantly prior to the cortical P3 response. This findings point to higher-order cognitive functions already at a subcortical level. Auditory events are categorized as behaviorally relevant in subcortical loops involving basal ganglia and thalamic regions. This label is then distributed to cortical regions by ascending projections [1].

Accurately locating small subcortical brain lesions is very important for maximal surgical resection with minimal neurological damage.

Intraoperative magnetic resonance imaging has proved to be more precise than ultrasound, it is relatively expensive and isn't available in all centers.

Kazanci et al. describe a new, simple, safe and effective method for determining a small skin incision and craniotomy via skin staples combined with intraoperative ultrasonography to determine the margins, vascularity and residue of the lesion [2].

1)
Beck AK, Lütjens G, Schwabe K, Dengler R, Krauss JK, Sandmann P. Thalamic and basal ganglia regions are involved in attentional processing of behaviorally significant events: evidence from simultaneous depth and scalp EEG. Brain Struct Funct. 2017 Sep 4. doi: 10.1007/s00429-017-1506-z. [Epub ahead of print] PubMed PMID: 28871419.
2)
Kazanci A, Gurcan O, Gurcay AG, Bozkurt I, Algin O, Turkoglu OF, Bavbek M. A simple, safe and effective surface marking and targeting method combined with intraoperative ultrasonography for small subcortical intracranial lesions. J Neurosurg Sci. 2015 Jul 14. [Epub ahead of print] PubMed PMID: 26173480.