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Brain Mapping of Auditory Hallucinations and Illusions Induced By Direct Intracortical Electrical Stimulation

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Abstract

The genuine structure of the human auditory cortex stays a concern of debate, with discrepancies between purposeful and microstructural studies. In a hierarchical framework for sensory perception, easy sound appreciation is predicted to take region in the foremost auditory cortex, whilst the processing of complex or greater built-in perceptions is proposed to depend on associative and higher-order cortices. The intracranial recordings of these evoked perceptions of various tiers of integration supply the proof to talk about the theoretical model. We analyzed SEEG recordings from 50 epileptic sufferers offering auditory signs and symptoms brought on by way of DES. First, the usage of the Juelich cytoarchitectonic percolation, we quantified which areas precipitated auditory signs and symptoms when motivated (ROI approach). Then, for every evoked auditory symptom kind (illusion or hallucination), we mapped the cortical networks displaying concurrent high-frequency endeavor modulation Conscious experience, whether or not in fitness or disease, stems from the integration of cortical indicators originating from a complicated panorama of spatially wonderful but temporally synchronized Genius regions.

Keywords: Bipolar disorder; Psychosis; Schizophrenia

Introduction

At the interface with the surroundings and the sensory organs, rather unique important cortices have been proposed to occupy the floor stage of a hierarchical perceptual architecture. In this framework, the incoming sensory sign is fed ahead with developing ranges of integration however lowering specificity to the greater order areas of this hierarchy, in order for grasp and cognitive tactics to take area In the auditory modality, one consequently expects authentic sound perceptions to be first encoded in the posterior ideal temporal gyros, and modulations to be encoded in secondary, associative, or integrative areas, such as in the ventral and dorsal auditory streams and the insula. In epilepsy, mindful perceptions might also originate no longer from peripheral sensory data however from neural discharges at some point of seizure activity, immediately in the talent areas typically accountable for these perceptions. Thus, the patient's trip of seizures, or semiology, which at first publications the comparison and speculation on the viable vicinity of the epileptogenic region. Also informs on the cortical localizations and interactions ensuing in perception. In particular, auditory auras discovered in 1.3–2.4% of focal epileptic seizures. We hypothesize that auditory signs caused by way of direct electrical stimulation (DES) provide a window into the structure of the Genius networks concerned in auditory hallucinations and illusions. While the modulatory thing precise to illusions was once predicted to be induced through stimulation to secondary associative or greater order auditory areas of the temporal lobe, or even areas of the ventral and dorsal auditory streams.

Discussion

These factors argue in want of an allotted community of interconnected and synchronized neurons underlying understanding and cognitive function, however the way this community is prepared stays an open question. With the existing study, we for this reason intention at higher characterizing the cortical networks underlying DES-induced auditory hallucinations and illusions in a giant cohort of 50 epileptic sufferers who underwent stereotactic intracerebral EEG (SEEG) recordings as section of their presurgical evaluation. We used DES to interrogate the impact of the kind of appreciation on the cortical networks involved, with on one hand hallucinations taking place sine material, or regardless of no exterior corresponding sound source, and on the different hand illusions consisting in a peculiar modulation of an current sensory input. First, in a Region of Interest – ROI – approach, we associated the discovered signs to the stimulation site. We hypothesized that each illusions and hallucinations would be evoked from auditory regions. However, owing to the hierarchical framework for sensory perception, we anticipated to discover hallucinations normally elicited in the major auditory cortex. IN addition, we predicted to locate no main auditory web sites to elicit illusions. Then, we carried out probabilistic mapping of excessive frequency things to do (HFA, 70–150 Hz) elicited regionally and at far away web sites all through stimulation, when auditory signs have been produced, to set up the hyperlink between the discovered signs and symptoms and the cortical community disturbed through the stimulation procedure. From a methodological standpoint we hypothesized that the cortical modulations discovered throughout stimulation are consultant of the subsequent perceptual consequence. By confining to the time window described through the stimulation, and with excellent administration of the stimulation artifact, consequences will hence be free of post-discharge associated biases. From a symptom mapping factor of view, we count on for each phenomena to be linked to networks of auditory processing, involving the ultimate temporal lobe from its posterior essential auditory cortex, to its anterior semantic processing associated regions, as nicely as the front-parietal areas of the motor integration. We additionally count on the limbic system, with the insula, hippocampus, amygdala, and cingulate cortex.to play a tremendous position in the concerned networks, mainly given that each illusions

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and hallucinations diverge from the ordinary sensory representations. There are two components of the limbic device that appear especially relevant [1-6].

First, the grasp of unusual sounds, recognized as now not originating from the ordinary environment, is probable to endure a strange emotional valence, which would be decided in specific in the anterior insula and amygdala. The 2nd element relates to the gating mechanisms mediated via auditory limbic connections, which have been considerably studied in the context of tinnitus a phantom sound appreciation which would belong to the hallucination class as described in the existing study. A complete of 109 sufferers offering focal drug resistant epilepsy observed eligible for surgical operation underwent preferred pre-surgical critiques the usage of intracerebral recordings at Grenoble-Apes University Hospital. All sufferers gave written knowledgeable consent to rise out SEEG exploration as nicely as non-invasive examinations along with excessive decision magnetic resonance (MRI) imaging, video-EEG monitoring, neuropsychological assessment, and computed tomography (CT) scanning. For the cause of this study, we reviewed the consequences of all DES techniques carried out over the length of time, following standardized methods used at the hospital. We recognized 50 sufferers who skilled auditory signs for the duration of SEEG evaluation, with the electrically caused auditory signs unrelated to everyday seizure signs (patient traits are documented in supplementary material. Cortical implantation resolution used to be completely based totally on medical purposes, with no reference to the existing experimental protocol. Eleven to fifteen semi-rigid, multi-lead electrodes have been stereotactic ally implanted in every affected person (stereotactic EEG –SEEG-).using a robot-assisted technique. The SEEG electrodes had a diameter of 0.8 mm and, relying on the goal structure, consisted of 8–15 contact leads two mm broad and 1.5 mm aside (i.e. 3.5 mm center-to-center, DIXI Medical Instruments). Implantation was once unilateral in 35 instances (11 right-sided, 24 left-sided) and bilateral in sixteen cases. Patients underwent a preoperative MRI scan and a post-operative MRI or CT scan. Preoperative and postoperative scans have been co-registered in order to acquire electrode role coordinates in concern space. Transform to fashionable area used to be computed the usage of SPM12 (Statistical Parametric Mapping 12, Welcome Department of Imaging Neuroscience, University College London, www.fil.ion.ucl.ac.uk/spm), and electrode positions have been then expressed in MNI coordinates. Visual inspection for all electrode places used to be performed, to test for right co-registration and to realize whether or not contacts had been in gray or white matter. Neuroanatomical labeling of MNI coordinates of electrode contacts was once carried out the usage of an in-house software, Intranets Electrodes. The Kulich Brain atlas percolation scheme used to be chosen to outline the areas of pastime of the existing learn about for its excessive precision, primarily based on autopsy cytoarchitectonic analysis, in the peri-auditory regions. SEEG recordings lasted from 1 to three weeks. A Micro med audio-video-EEG monitoring device was once used to lift out experiments (Micro med, Treviso, Italy) presenting up to 128 recording contacts, with a sampling frequency of 512 Hz, and acquisition band pass filter between 0.1 and 200 Hz. Acquisition was once carried out the use of a referential montage with the reference electrode placed in the white rely and all different recording websites in the gray matter. For sign analysis, a bipolar montage between adjoining contacts of the equal electrode was once used, to enhance sensitivity to neighborhood contemporary generators. DES was once commonly carried out in 1 to 3-h classes over more than 1 day below non-stop video-EEG monitoring, to reproduce the patient's routine scientific seizures and to map functionally applicable areas to be spared throughout surgery Have by and large been linked to seizure onset zones positioned in the auditory cortex at the posterior component of the ultimate temporal gyros, such as Herschel's gyros and the auditory affiliation cortex, as properly as in parietal or frontal regions. Furthermore, DES has tested an accurate proxy to find out about Genius feature and agency outdoor of epileptic seizures, permitting to map functionally eloquent areas for the duration of the medical work-up prior to surgery. Past research the usage of DES have proven that repeated stimulation of the identical Genius area did no longer persistently produce the identical effect, and conversely, stimulation of extensively allotted areas of the talent ought to yield comparable symptoms [7-11].

DES used to be utilized between two adjoining electrode contacts (bipolar stimulus) the usage of a modern-day generator handing over choice rectangular wave pulses (Micro med, Treviso, Italy), and in accordance to parameters acknowledged to produce no structural damage. Following general medical procedure. DES used to be carried out at 1 Hz (pulse width: 1 m,s; DES duration: 40s) and at 50 Hz (pulse width: 0.5–1 m,s; DES duration: 5s), with stepwise growing intensities (0.5 to a most of 5 mA) till medical responses had been elicited (after-discharges or electro-clinical seizures). The experimental setup allowed sufferers to be sitting upwards on the bed, going through the camera. Tasks commonly protected counting or list collection of words. Depending on the anticipated or found medical responses, different duties ought to be undertaken (e.g., alternate forearm movements, finger tapping, listening to the observer's voice, photo naming, etc.). Patients had been requested to document any symptom they skilled as quickly as viable and have been at once examined and cautiously wondered by way of the observer. Clinical and electrical findings had been documented the use of a standardized form, and saved on difficult drive. First, single trials have been processed following the epileptogenicity mapping manner developed in our crew and currently used for language mapping. Periods of activity of the SEEG recordings had been taken at some point of DES and baseline undertaking was once chosen in the s interval prior to stimulation onset. All time collection has been changed into time-frequency maps for every channel [12-14].

Spectral energy was once computed between 70 and a hundred and fifty Hz with a 1 Hz frequency resolution, the usage of a Henning-tapered decomposition with a constant window size of 1s and a hundred m,s step size. A notch filter used to be utilized to do away with harmonics of line noise between ninety eight and 102 Hz, and between 148 and 152 Hz. Z-score normalization of DES time frequency maps used to be carried out via dividing the DES sign to time frequency area radically change via the suggest baseline estimate. Stimulation artifacts suppressed by way of ignoring values of z-scored SEEG strength above 10, and outliers have been overlooked by way of averaging over the frequency dimension when computing SEEG energy time series. For sake of caution, SEEG strength matrix factors with a z-value above 10 in over 5% of channels had been removed, inclusive of these for which the threshold used to be now not reached. The time frequency maps in the chosen time boxes have been log-transformed and spatially interpolated to produce pictures for statistical analysis. In widespread space, the electricity values for every electrode contact have been mapped to the corresponding electrode contact position [15].

Conclusion

The most useful temporal airplane indicates full-size person variability. We can't utterly forget about a viable have an impact on of interindividual variability on our results, regardless of spatial

realignment. This might also account for a positive quantity of dispersion in spatial mapping; however we do now not assume that this would lead to most important areas merging with spatially faraway secondary areas such as the STS, consequently our primary observations hold. To the pleasant of our knowledge, the current dataset is the biggest present record of DES-induced auditory symptoms, offering a giant spatial insurance of talent regions. Yet we can't deny that this insurance stays sparse and is problem to a sampling bias. The ROI strategy and the thresholding used – a minimal of 10 recordings per ROI, well known and offers with this issue, at the value of diminishing the very excessive spatial decision of the uncooked SEEG data.

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Conflict of Interest

None

References

1. Flavie W, Charles F (2017) Hallucinations: A Systematic Review of Points of Similarity and Difference Across Diagnostic Classes. Schizophr Bull 43:32-43.
2. Siu WT, Wayne HT (2020) Hallucinations: diagnosis, neurobiology and clinical management. Int Clin Psychopharmacol 35: 293-299.
3. Charles F (2019) Modality-general and modality-specific processes in hallucinations. Psychol Med 49: 2639-2645.
4. Renaud J, Kenneth H, Matthew H, Jerome B, Flavie W, et al. (2016) Are Hallucinations Due to an Imbalance Between Excitatory and Inhibitory Influences on the Brain?. Schizophr Bull 42: 1124-1134.
5. Marcella M, Pantelis L, Charles F, Flavie W, Frank L, et al. (2021) A Review of Multimodal Hallucinations: Categorization, Assessment, Theoretical Perspectives, and Clinical Recommendations. Schizophr Bull 47: 237-248.
6. kenneth H (2017) Auditory Hallucinations as Translational Psychiatry: Evidence from Magnetic Resonance Imaging. Balkan Med J 34: 504-513.
7. Gras A, Amad A, Thomas P, Jardri R (2014) [Hallucinations and borderline personality disorder: a review]. Encephale 40: 431-438.
8. Franco DM, Cesare D, Gabriella G, Andrea P (2015) Hallucinations in the psychotic state: Psychoanalysis and the neurosciences compared. Int J Psychoanal 96: 293-318.
9. Shusaku O, Hidetomo M, Tomotaka S, Keiko B, Tadashi U, et al. (2021) Risk factors for minor hallucinations in Parkinson's disease. Acta Neurol Scand 143: 538-544.
10. Kirk R, John F, Frances S (2011) Auditory hallucinations: a review of assessment tools. Clin Psychol Psychother 18: 524-534.
11. Eli EM, Brian MG, Sara CC, Matthew SR (2015) Auditory hallucinations associated with migraine: Case series and literature review. Cephalalgia 35: 923-930.
12. Barnes J, David AS (2001) Visual hallucinations in Parkinson's disease: a review and phenomenological survey. J Neurol Neurosurg Psychiatry 70: 727-733.
13. Eellan S, Melvin CG, Keith AC (2016) Opioid-induced Hallucinations: A Review of the Literature, Pathophysiology, Diagnosis, and Treatment. Anesth Analg 123: 836-843.
14. Elif DS (2021) Isotretinoin-induced visual hallucinations in a patient with acne vulgaris. Pediatr Dermatol 38: 1349-1350.
15. Judith MF, Thomas D, Derek JF, Christoph SH, Daniela H, et al. (2012) Neurophysiological studies of auditory verbal hallucinations. Schizophr Bull 38: 715-723.