37 - C. ERP

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© SPMM Course Diffuse slowing of background is the most common EEG abnormality; it is nonspecific and signifies the presence of encephalopathy. Focal slowing suggests local mass lesions; e.g. edema, haematoma or focal seizure. Epileptiform discharges when seen interictally, can be considered as hallmark of seizure disorder. But this is not a common finding. If this is lateralized and periodic, it may suggest an acute destructive brain lesion.

Effect of drugs on EEG

B. MEG Magnetoencephalography (MEG) is used to measure the magnetic fields produced by electrical activity in the brain In contrast to electric fields, magnetic fields are less distorted/impeded by the skull and scalp. The scalp EEG is sensitive to both tangential and radial components of a current source in a spherical volume conductor, MEG detects only its tangential components. Thus, MEG may selectively measure the activity in the sulci, whereas scalp EEG measures activity both in the sulci and at the top of the cortical gyri. C. ERP An ERP is a change in electrical brain activity stereotyped and time-locked to an event (e.g., stimulus), although it can also occur for the omission of an expected stimulus. ERPs allow the investigation of specific types of information processing by the brain. ERPs are small relative to the spontaneous brain activity (background EEG) that is they have a low signal-to-noise ratio. To increase the signal-to-noise ratio, an often-used method is ERP averaging Psychotropics Antipsychotics Slowing of beta activity with increase in alpha, theta and delta activity Antidepressants Slowing of beta activity with increase in alpha, theta and delta activity Lithium Slowing of alpha or paroxysmal activity Anticonvulsants No effect on awake EEG Primarily sedating drugs – decrease alpha Barbiturates Effects are opposite to that of alcohol. Increased beta activity upon intoxication; generalized paroxysmal activity and spike discharges (even without overt fits) in withdrawal states. Benzodiazepines Increased beta; decreased alpha. Overdose leads to diffuse slowing Opioids Decreased alpha activity; increased voltage of theta and delta waves; in overdose, slow waves are seen. Primarily recreational drugs – increase alpha Alcohol Increased alpha activity; increased theta activity. Withdrawal increases beta. Delirium tremens has beta (fast) wave activity – other deliria have increased slow waves. Marijuana Increased alpha activity in frontal area of brain; overall slow alpha activity Cocaine Same as marijuana; longer lasting. Nicotine Increased alpha activity; in withdrawal, marked decrease in alpha activity Caffeine In withdrawal, increase in amplitude or voltage of theta activity

© SPMM Course ERPs have polarity (positive [P] or negative [N]) and latency (the moment of peak occurrence after stimulus presentation, which is often indicated by the number attached to the labels of ERP activity). The temporal resolution of EEG, MEG and ERP analysis is much higher

than that of other neuroimaging methods like functional MRI, SPECT and PET, but these techniques lack the high spatial resolution of the MR techniques. According to the time of occurrence ERPs, can be classified as early, mid latency and late. The P300, a positive late ERP component around 300 ms after stimulus presentation, is typically generated when a rare target stimulus is imbedded with more frequent stimuli e.g. (auditory 'oddball' protocol). The P300 is related to the maintenance of working memory. Decrease in P300 amplitude is well established as a biological trait marker in schizophrenia. The Mismatch Negativity or MMN is a negative ERP component that is recorded between 100-200 ms in response to low-probability deviant sounds (oddball) in a sequence of standard sound stimuli, when the participant is not actively attending to the deviants. The MMN is best seen in the difference wave between the ERP in response to the standard and deviant sounds. The MMN reflects involuntary information processing in auditory context, i.e. the mnemonic comparison of a given stimulus with a previous one that has already built up a trace in memory. The violation of the previously formed memory trace produces the MMN. Decreased MMN amplitude is noted in schizophrenia. The Contingent Negative Variation (CNV) is a slow negative shift in the interval between two paired stimuli presented one after the other (S1 being the cue, S2 being the imperative stimulus prompting to respond). CNV reduction in central (midline) electrodes is noted in schizophrenia patients especially with long duration of illness with positive symptoms.

•Basic sensory pathways can be studied by recording early ERPs. •These are also called 'evoked potentials' (EPs) or brain stem evoked responses (BAER) •They occur in response to sounds (Auditory EP, AEP), flashes (Visual EP, VEP) or electrical stimulation (Somatosensory EP, SEP). Early ERPs Early ERPs • These occur after BAER. •The three well known midlatency ERPs are N100, P50 and P200. •Their amplitudes reduce with repetition (habituation response / sensory gating). Midlatency ERPs Midlatency ERPs •Cognitive pathways can be studied by recording of ERPs related to the execution of psychological events such as attention, emotion or memory tasks. •P300 and MMN are late ERPs Late ERPs Late ERPs

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