Despite advances in functional and structural neuroimaging, ictal EEG remains the critical study for characterization of the seizure focus. Unfortunately, seizures arising from extratemporal epilepsy (EE) are more difficult to characterize electroencephalographically than those arising from temporal regions.

In frontal lobe epilepsy, the epileptic zone is either from the lateral frontal lobe (LFLE) or mesial frontal lobes (MFLE). Although ictal and interictal discharges are seen more in LFLE than MFLE, it is less common than those of temporal lobe epilepsy (TLE). Invasive chronic EEG recording may be needed in as high as 50% of patients with frontal lobe epilepsy compared to those with TLE where only 16% or less needs invasive recordings. The difficulties in interpreting surface EEG originating from LFLE may be due to the abrupt onset of the motor activity, which tends to obscure the initial ictal EEG recording. Lateral frontal lobe epilepsy patients may exhibit secondary bilateral synchrony in which epileptiform discharges appear to be bifrontal or generalized (although this occurs more commonly with MFLE). While there are often subtle asymmetries or time-phase differences supporting lateralization to one side, the distinction can be very difficult.

Interictal background and epileptiform abnormalities can lend support to the ictal EEG recordings. In addition to providing localizing information in patients with frontal lobe epilepsy, it may provide prognostic information for patients undergoing frontal resections. At times, the interictal discharges provide adequate localization of the lateral frontal lobe seizure focus but not sufficient localizing information. In this setting, intraoperative electrocorticography (ECoG) may be necessary for better localization of the focus.

The value of intraoperative ECoG in defining the surgical boundaries during epilepsy surgery has been hotly debated however, it might be of diagnostic and prognostic value especially the LFLE which is readily accessible for recording. Intraoperative ECoG helps to define abnormal (lesional) tissue when the pathological boundaries are not discrete. Furthermore, it may provide critical information when complete resection of a lesion is not possible due to functional constraints. Finally, intraoperative ECoG sometimes accomplishes adequate localization of the lateral frontal epileptogenic focus without chronic intracranial recordings that are associated with greater cost and higher morbidity. Focal cortical dysplasia is usually associated with continuous epileptiform discharges, more than isolated spikes. Palmini et al, have found that complete abolition of the continuous epileptiform discharges is usually associated with a much better surgical outcome.

Mesial frontal lobe epilepsy. Ictal EEG recording usually shows bilateral asynchronous discharges and subtle lateralization may be present. Recording during sleep is important if lateralizing information is not to be missed. In patients with bilateral asymmetrical tonic seizures, intermittent rhythmic midline frontocentral slowing is usually seen. An absence of any ictal or immediate postictal EEG slowing has been reported in patients with MFLE. The demonstration of an EEG seizure pattern may require examination of multiple recorded seizures to detect a subtle but reproducible pattern. The interictal EEG in patients with mesial frontal lobe epilepsy most commonly shows an abundance of nonlateralized epileptiform activity or none at all. Focal epileptiform activity appears to be more common in lateral frontal lobe foci. In 77% of patients, scalp EEG reveals no interictal epileptiform discharges with MFLE. Focal interictal spikes and sharp waves at or adjacent to the midline are seen in patients with tonic postural seizures. In bilateral asymmetrical tonic seizures, scalp EEGs recorded during long-term video-EEG monitoring may show midline frontocentral interictal epileptiform discharges in 50% of the patients.
Midline discharges present only during sleep and may be difficult to distinguish from vertex sharp waves of sleep, especially in children.

The scalp EEG may also be very misleading. Only a minority of reported patients had interictal or ictal epileptiform activity restricted to the parieto-occipital region. Interictal spikes often occur in the temporal regions, may be bilaterally synchronous or appear generalized, or may be absent altogether. Invasive electrodes are not always successful at determining a well-defined ictal onset zone. Due to the common involvement of the temporal lobe in interictal and ictal patterns, invasive electrode placements should cover this region as well as the mesial and lateral parietal and occipital lobes. Illustrations of different ictal and interictal EEG patterns will be demonstrated.

Further Reading


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