34

The intimate relationship between coalescent generators in early premature neonates

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Background Spontaneous endogenous generators are key elements in immature systems. Theta activity (TA) and the coalescent slow waves (SW) occur from 25wGA and address the basic mechanisms of cross frequency interdependencies in oscillations that compose brain rhythms in premature.
Objectives To evaluate the interactions between the two oscillations using phase-amplitude coupling.
Methods EEGs of 34 prematures (25—27wGA) were analyzed. Temporal relationships between TA and SW were assessed, using event-locked analysis. SW and TA were automatically detected. Artifact-free epochs time locked to the SW trough were extracted. Time-frequency representations (TFRs) were calculated. To quantify locking between the SW phase and the TA power, a synchronization index was computed. To investigate the temporal relationships between SW and TA, event histograms were created referenced to the SW trough and TA peak.
Results TFR analysis demonstrated that TA power was increased during the SW descending slope and around the SW trough and showed a lasting suppression during the SW peak. Event histogram analysis confirmed the consistent timing of TA during SW cycle. Maximum TA was reached before the SW trough.
Conclusion This cross frequency coupling with a so precise intimate temporal relationship between rapid and slow oscillators constitutes an index of ''ideal'' mechanisms with unique functional and structural wiring in the auditory network, disruptions of which might be of dramatic neurodevelopmental consequences. Coupling between the phase of the slow oscillations and the amplitude of theta oscillations in this early neural biomarker might suggest developing network level dynamics in early prematurity.
Keywords Phase-amplitude coupling; Premature; Spontaneous generators

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35

Plasticity of neonatal neuronal networks in very premature infants: Source localization of temporal theta activity, the first endogenous neural biomarker, in temporoparietal areas

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Background Temporal theta slow-wave activity (TTA-SW) in premature infants is a specific signature of the early development of temporal networks, as it is observed at the turning point between nonsensory driven spontaneous local processing and cortical network functioning. Previous studies have demonstrated that preterms from 28 weeks of gestational age (wGA) are able to discriminate phonemes and voice, supporting the idea of a prior genetic structural or activity-dependent fingerprint that would prepare the auditory network to compute auditory information at the onset of thalamocortical connectivity.
Objectives To specify the role in development and the specific location of TTA-SW.
Methods We recorded TTA-SW in 26—32 wGA preterms. The rate of TTA-SW in response to click stimuli was evaluated using low-density EEG in 30 preterms. The sources of TTA-SW were localized by high-density EEG using different tissues conductivities, head models and mathematical models.
Results We observed that TTA-SW is not sensory driven. Regardless of age, conductivities, head models and mathematical models, sources of TTA-SW were located adjacent to auditory and temporal junction areas. These sources become situated closer to the surface during development.
Conclusion TTA-SW corresponds to spontaneous transient endogenous activities independent of sensory information at this period, which might participate in the implementation of auditory, language, memory, attention and or social cognition and represents a general interaction between the subplate and the cortical plate.
Keywords Development; Endogenous oscillations; Source localization

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36

Preterm modulation of connectivity by endogenous generators: The theta temporal activities in coalescence with slow waves

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Background The neuronal activity of the preterm brain is characterized by various endogenous activities whose roles in neurodevelopmental maturation processes have not been fully elucidated. The preterm EEG is characterized by discontinuities composed of short bursts of activity with dominant low frequencies. One of the earliest endogenous activities is the theta temporal acti-

vity in coalescence with slow waves (TTA-SW), which appears at 24 to 32 weeks of gestational age (wGA).
Objectives The present study investigated the influence of TTA-SW on the spatial organization of the early preterm brain network.
Methods High-Density EEG (HD-EEG) data were recorded from preterm infants (29—32 wGA) and functional connectivity (FC) was estimated from the scalp EEG.
Results TTA-SW, particularly in the theta band, induced increased FC between left temporal and left frontal areas and between left temporal and parietal areas with TTA-SW at the left temporal region, while FC was limited to the right temporal regions in the case of TTA-SW at the right temporal region. Regardless of the lateralization of TTA-SW, long-range FCs were observed between left frontal to left parietal areas, suggesting that these regions, together with the temporal region, provide a basis for coherent neuronal activation across distal cortical regions.
Conclusion TTA-SW dynamic features showed that brief phases of TTA-SW had an impact on both local and whole brain network organization, supporting the importance of TTA-SW as a biomarker of brain development.
Keywords Functional connectivity; Preterm; Theta temporal activity

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37

The nerve conduction study is the key tool for the assessment of a peripheral neuropathy after carbon monoxide intoxication in a young adolescent mimicking a central presentation

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Background Peripheral neuropathy after carbon monoxide (CO) intoxication is rarely reported. A peripheral nerve dysfunction mimicking a central presentation has never been reported.
Objectives To determine the place of nerve conduction studies (NCS) in the assessment of peripheral neuropathy following CO intoxication.
Methods We reported the case of a young patient aged 21 years who was addressed to the electrophysiological department Sahloul to perform NCS one year after a severe CO intoxication. He developed during his hospitalization, a left hemiparesis (lower and upper limbs). The NCS was not performed at this time. The diagnosis was rhabdomyolysis complicated by an acute renal failure due to CO poisoning in a patient with central nervous system complication. Actually the physical examination revealed the left hemiparesis with conserved or even exaggerated reflexes. These clinical features were compatible with a central dysfunction. However, when performing NCS on the left side, sural, superficial peroneal, ulnar, and median sensory nerve action potentials were unobtainable, as well as peroneal and tibial compound muscle action potentials. Such findings evoke a diffuse peripheral neuropathy with axonal dysfunction. This association was not reported after CO intoxication.
Results Although demyelinating neuropathy is the mostly common reported form of neuropathy after CO intoxication, axonopathy can also be occurred but needs more times to recover. Rhabdomyolysis and CO itself are the major factors leading to peripheral neuropathy.
Conclusion A peripheral neuropathy mimicking a central presentation can occur after CO intoxication. Clinicians should be aware of the major implication of the peripheral nervous system in this context.
Keywords CO intoxication; Neuropathy; Rhabdomyolysis

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38

Valeur pronostique du monitorage par électroencéphalographie d'amplitude dans le traumatisme crânien modéré à sévère pédiatrique

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Contexte Chaque année en France surviennent 4000 traumatismes crâniens pédiatriques modérés ou sévères, grêvés d'une morbi-mortalité importante. La prise en charge initiale vise à limiter les lésions secondaires via un monitorage multimodal. L'EEG d'amplitude (aEEG) n'a pas été évalué dans cette indication.
Objectifs Évaluer les apports diagnostique et pronostique de la tendance aEEG dans le traumatisme crânien en réanimation.
Méthodes Nous avons rétrospectivement recueilli les données cliniques, électrophysiologiques et thérapeutiques, les imageries et le devenir des enfants hospitalisés en réanimation pédiatrique au CHU de Reims pour traumatisme crânien modéré ou sévère, entre le 01/01/2015 et le 31/08/2018, avec monitorage cérébral continu par aEEG. Nous avons caractérisé l'aEEG par période de 6 h selon : sa qualité, la classification d'Hellström-Westas, les valeurs moyennes des marges inférieure et supérieure, la présence de modulation, la détection de crises. Les corrélations électrocliniques ont été étayées par des tests de Student, Khi^2, Anova selon les variables considérées.
Résultats Quarante-et-un patients ont présenté un traumatisme crânien modéré ou sévère, dont 27 ont bénéficié d'un monitorage aEEG. En moyenne, l'enregistrement débutait dans les 4 premières heures pour 93 h. La présence d'une modulation avant 6 h et 12 h de vie était significativement associée à un meilleur devenir. La détection de crises convulsives n'était pas péjorative dans cette observation.
Conclusion Le monitorage aEEG est facilement réalisable dans cette population. La présence précoce d'une modulation des amplitudes est associée à un bon pronostic. Un travail prospectif est nécessaire pour évaluer l'apport d'un monitorage continu aEEG/EEG couplé.
Mots clés Electroencéphalogramme d'amplitude ; Monitorage ; Soins intensifs

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