



Clinical correlates of frontal intermittent rhythmic delta activity (FIRDA)

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ARTICLE INFO

Article history:

Accepted 9 June 2010

Available online 29 July 2010

Keywords:

EEG
Encephalopathy
Brain lesions
Epilepsy

ABSTRACT

Objectives: To investigate the clinical correlates of frontal intermittent rhythmic delta activity (FIRDA). **Methods:** we prospectively assessed all EEG studies recorded in our center over 3 months for the presence of frontal intermittent rhythmic delta activity (FIRDA). The FIRDA group was compared with a randomly selected control group from among EEGs recorded during the same period. Comparisons among FIRDA and non-FIRDA groups were performed using uni- and multi-variate analyses.

Results: We found 36 patients with FIRDA among 559 EEG recordings (6%); the control group consisted of 80 subjects. While epilepsy was more frequent in the control group, structural brain lesions and encephalopathy were independently associated with the occurrence of FIRDA, but we could not identify any specific etiology. Asymmetric FIRDA was associated with an underlying brain lesion. Occasionally, FIRDA was recorded in otherwise healthy subjects during hyperventilation.

Conclusion: FIRDA appears more common than previously reported, and is associated with a wide range of lesions and encephalopathic conditions.

Significance: FIRDA occurrence should prompt investigations for toxic-metabolic disturbances and for structural lesions (particularly if asymmetric), but does not suggest an epileptic predilection.

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1. Introduction

Rhythmic delta activity in human EEG was first extensively described by (Cobb, 1945). Since then, studies have addressed the nature and clinical significance of these slow, rhythmic wave forms that often exhibit a frontal predilection and are known as frontal intermittent rhythmic delta activity, or FIRDA (Daly et al., 1953; Cordeau, 1959; Hooshmand, 1983). In early descriptions, many groups correlated it with deep midline lesions, and hypothesized a relationship with increased intracranial pressure (Leschey et al., 1978; Cordeau, 1959). Later studies contended that such etiologic factors comprised only a small percentage of all conditions associated with FIRDA. These included tumors of the posterior fossa and third ventricle (Faure et al., 1951; Daly et al., 1953), sub-cortical lesions (Jasper and Vanburen, 1953), cerebral edema (Gastaut et al., 1979), cerebrovascular accidents, abscesses, encephalitis, metabolic encephalopathy (Fariello et al., 1982), basilar artery migraine (Pietrini et al., 1987), Lewy body dementia (Roks et al., 2008), progressive supranuclear palsy and corticobasal degeneration (Wieser et al., 2004), and even Creutzfeldt–Jacob disease (Tashiro et al., 2006). More than 20 years ago, two retrospective works (Fariello

et al., 1982; Hooshmand, 1983) concluded that FIRDA could occur in a large variety of neurological disturbances as a transient phenomenon that could evolve into other types of EEG abnormalities. In particular, FIRDA was observed with alterations in consciousness and, in the absence of encephalopathic changes, FIRDA was mostly seen with focal structural lesions. A recent study confirmed these findings (Watemberg et al., 2002), and suggested that FIRDA most frequently occurred with diffuse brain injury, along with mild to moderate metabolic impairment. Strikingly, half of the patients had renal failure, while the incidence of brain tumors was low.

Important limitations shared by previous works are the retrospective identification of FIRDA, the lack of complete clinical and laboratory data, and absence of control groups, along with an unclear definition of FIRDA.

In this study, we sought to overcome these limitations by investigating the clinical correlations of FIRDA in our tertiary EEG center population, using defined electroencephalographic inclusion criteria, a prospective identification, and including radiological and laboratory data.

2. Methods

In this cross-sectional study, nested in a hospital cohort, we prospectively assessed all EEGs recorded in our tertiary care facility (Lausanne University Hospital), including routine wakefulness,

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sleep, and long-term EEG monitoring, between May 15th and August 15th, 2009. All studies were recorded with a bipolar longitudinal montage (using 21 or 23 electrodes arranged to the international 10–20 system), and interpreted on digital machine

using bipolar and average referential montages. We included all subjects older than 1 month of age, since EEGs in newborns and premature infants (below 1 month) are often characterized by physiological delta slowing, which may be semi-rhythmic or peri-



Fig. 1. Typical symmetrical (1a) and asymmetrical (1b) FIRDA (30 mm/s, 100 μ V/cm).

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