Which make us to have a follow-up brain MRI in patients with focal seizure?

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Background

- **Focal cortical dysplasia (FCD)**
  - Macroscopic or microscopic abnormalities of the cerebral cortex
  - Arise as a consequence of an *interruption to the normal steps of formation of the cortical plate*
  - The most commonly encountered developmental malformation that causes *refractory epilepsy*

- **Pathology of FCD**
  - **Mild**: neuronal heterotopia or dyslamination
  - **Severe**: bizarre and large pyramidal neurons within cortex and white matter, balloon cells
Background II

- **Magnetic resonance imaging**
  - First choice of diagnosis
  - MRI negative FCD in 1/3 of cases
  - Better seizure outcome in MRI positive FCD after surgery
  - FDG-PET or SISCOM
  - Subdural grid

- **Follow-up brain MRI**
  - In case of persistent partial seizures
  - With the advance of MRI technology (1.5T → 3T)
  - Lesions can become evident with age in pediatric patients
Purpose

• To evaluate the value of follow-up MR imaging in identifying the potential epileptogenic focus in children with localization-related epilepsy and negative initial MR imaging
Patients and Methods

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- **890 pediatric patients** with localization-related epilepsy (LRE) underwent **at least two brain MR images** in Samsung Medical Center

- Retrospectively reviewed the medical records and **MR images** of children with localization-related epilepsy and negative initial MR imaging
Patients and Methods

• Positive follow-up MR imaging
  • Focal cortical lesion
  • Hippocampal sclerosis
  • Other abnormalities

• Focal cortical lesion
  • Newly appeared lesion
  • Initially overlooked lesion
Patients and Methods

Localization score

• Seizure
  • Homogeneity of semiology
  • Laterality
  • Todd paralysis or Jacksonian march
  • Seizure frequency

• EEG
  • Localized ictal rhythm
  • Localized epileptiform discharges
  • Localized slow activity
  • Normal, multifocal or generalized slow or epileptiform discharges
Results

- Interval between two imagings: $3.7 \pm 3.64$ years

- Overall incidence of LRE with negative initial MR imaging: 44% (389/890)

- Positive in follow-up MR imaging: 81 children (21%, 81/389)

- Potential epileptogenic focus
  - 37/389 (9.5%) children with negative initial MR imaging
  - Focal cortical dysplasia: 21
  - Hippocampal sclerosis: 18
Results

- Distribution of FCD (N=21)
  - Frontal: 7
  - Temporal: 5
  - Parietal: 4
  - Occipital: 3
  - Diffuse abnormality: 2
Results: *Explanations for positivity in f/u*

- **Focal cortical dysplasia** (N=21)
  - Initially overlooked lesions: 17
    - *Increased extent of the lesion*: 14
    - No interval change of the size: 3
  - Newly appeared lesion: 4

- **Possible explanations**
  - Less than two years of age on the first MRI: 6
  - Initially subtle lesion → more clear or increased extent: 11
  - 1.5 T or poor image quality: 5
  - Radiologist miss: 2
M/18 years old; overlooked
F/4mo → 9yr: initial negative
M/4yr → 14yr; 1.5T → 3T
M/12yr, 1.5T → 3T
Results; Lateralization value

- Partial seizure: 21
- Laterality in semiology: 14 (66.7%)
- Laterality or focality in EEG: 9 (42.9%)

- Localization score
  - Between age-matched group (positive group vs. negative group)
  - No significant difference (\( P=0.85 \))
Conclusions

- Children having LRE with negative initial MR imaging changed to positive finding during follow-up in 21% and 9.5% revealed potential epileptogenic focus.

- The reasons for change are mainly due to initial obscurity of the lesion, low study age, poor image quality including 1.5T imaging.

- There was no predictive factors in semiology and EEG for positive MR imaging in follow-up study.

- Follow-up MR may be useful in identifying the epileptogenic focus in children with refractory LRE whose initial MR imaging was negative.
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