Electrophysiological Correlates of Phonological Processing in Aphasia: A case report

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Background

Electrophysiological research using Mismatch Negativity

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Deficient processing of consonant contrasts in nearly all types of aphasia[3]

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Features **"voicing"** and **"place of articulation"** most vulnerable[3]

↳MMN delayed, distorted or even absent (standard between 150 – 250 ms)[3]

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Auditory comprehension problems based on phonological input problems![3,4]

Functional plasticity

Reorganization of language in homotopic areas of the right hemisphere after stroke[1,2]:

↳ as bilateral activation

↳ as shift to contralesional hemisphere

↓

Better restitution without shift to contralesional hemisphere![1,2]

Method

Subject

- 68 year old right-handed woman with Broca aphasia
- Ischemic stroke in left insular area + area left middle cerebral artery with involvement of Broca area

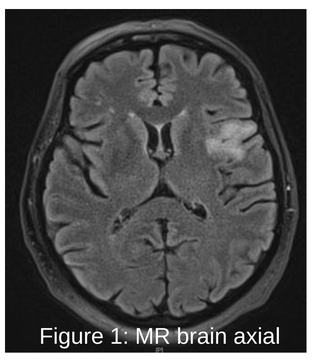

Figure 1: MR brain axial

Language test battery

- AAT
- PALPA (subtests phonological input)

Electrophysiology (EEG)

- Pre-attentive oddball paradigm (MMN)
- 3 different sets of stimuli auditory presented
- <u>Investigating processing of 3 distinctive features:</u>
  - ➢ Voicing
  - ➢ Manner of articulation
  - ➢ Place of articulation

Results

Aachen Aphasia Test (AAT)

<u>No abnormal scores for auditory language comprehension</u>

→ Auditory word comprehension: 29/30 (pc. 95)

→ Auditory sentence comprehension: 29/30 (pc. 95)

Psycholinguistic Assessment of Language Processing in Aphasia (PALPA)

<u>Still reveals lower scores for auditory discrimination!</u>

→ PALPA 1: 64/72 (M: 70.05; SD: 1.64; Range: 66-72)

→ Feature **"place"** most affected: 7/12 (M: 11.33; SD: 0.75; Range: 9-12)

Electrophysiology (EEG)

- Three MMN's were present: either delayed, attenuated or with changed distribution
- MMN for **"place"** confirms result on PALPA 1!
  → latency 208 ms BUT shift to right hemisphere!

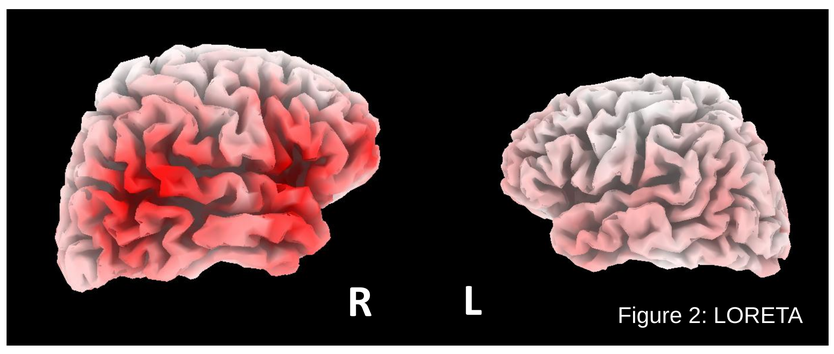

Figure 2: LORETA

Conclusion + discussion

This case report demonstrates:

1) How electrophysiology can reveal **contralesional activation** when processing a particular **distinctive feature**

2) <u>How this method can be a valuable supplement to logopaedic examination by:</u>
   - ➢ Making it possible to investigate **subtle comprehension problems**
   - ➢ Making it possible to formulate a **prognosis regarding recovery**

3) <u>Therapeutic implications:</u>
   - ➢ Focus on **phonological component** that is causing the contralesional shift in order to **impede activation of right hemisphere**

References

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2) **Tyler LK**, Wright P, Randall B, Marslen-Wilson WD, Stamatakis EA. **Reorganization of syntactic processing following left-hemisphere brain damage: does right-hemisphere activity preserve function?** Brain 2010; 133; 3396-3408
3) **Csépe V**, Osman-Sági J, Molnár M, Gósy M. **Impaired speech perception in aphasic patients: event-related potential and neuropsychological assessment.** Neuropsychologia 2001; 39; 1194–1208
4) **Becker F**, Reinvang I. **Successful syllable detection in aphasia despite processing impairments as revealed by event-related potentials.** Behavioral and Brain Functions 2007, 3:6

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