The pattern of language deficits in neurosurgical patients

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Introduction

Prior to a neurosurgical resection, most patients with tumors or epileptogenic foci in the left hemisphere of the brain show normal or close to normal language abilities. After the surgery, however, many patients present with significant language decline, which often resolves over several months (Duffau et al. 2003). Previous studies report different rates of aphasia in the acute post-operative phase, ranging from 17% to 100% (Papagno et al. 2012). The mechanisms of postsurgical language deficits are not fully understood. Most studies that attempted to analyze postsurgical language outcomes used comprehensive language testing (Davies et al. 2005); in others, subjective scoring of tests was extensively used (Wilson et al. 2015). We used the comprehensive and objectively rated Russian Aphasia Test (Ivanova et al. 2016) to examine the pattern of language deficits in the acute phase in patients who underwent a neurosurgery in the left hemisphere.

Methods

Participants

- 30 monolingual native Russian-speaking patients (16 female; age range 18-63, mean 41 y.o.)
- all but one right-handed (1 – ambidextrous)
- first surgery (28 patients underwent awake craniotomy, 2 were operated under general anesthesia
- with gliomas, cavernomas, metastatic tumors or epileptogenic foci in left-hemisphere perisylvian language regions

Language Tests

- All patient were assessed with the Russian Aphasia Test (RAT; Ivanova et al. 2016), before and 1-8 days after the surgery (median=5)
- Each testing session took ~1 hour

<table>
<thead>
<tr>
<th>Comprehension</th>
<th>Production</th>
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<tbody>
<tr>
<td>Phonological level</td>
<td>Repetition of pseudowords</td>
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<tr>
<td>phonological judgment of minimal pairs of pseudowords</td>
<td></td>
</tr>
<tr>
<td>Lexical level</td>
<td>picture naming of objects and actions</td>
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<tr>
<td>word-to-picture matching for objects and actions</td>
<td></td>
</tr>
<tr>
<td>Syntactic level</td>
<td>sentence construction in response to a picture</td>
</tr>
<tr>
<td>sentence-to-picture matching</td>
<td></td>
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</tbody>
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Results

1. Overall results

![Graph showing performance on comprehension and production tests](image)

- Before the surgery 90% of patients showed normal or close to normal language abilities
- 70% of subjects showed worsening after the surgery
- Production was affected significantly more than comprehension: t(29)=3.24, p=0.003

2. Changes in patients' performance: the effect of the processing level

- Comprehension: no significant difference between the tests
- Production: significant differences between all levels of processing (p-values corrected for multiple comparisons): worsening in syntactic > lexical > phonological

3. Correlations between postsurgical scores of all 6 tests

- All except one were strong and positive

Discussion

Though in the long-term perspective language recovery rate after neurosurgeries is high, in the acute post-surgical phase most of the patients demonstrate a decline in language abilities. Our results suggest that the observed deficits are rather non-specific in nature and are modulated by the cognitive load of the task. Future studies that would include lesional data and follow-up longitudinal studies are needed to further inform the nature of post-surgical language deficits.

References