Long-term outcomes in children with congenital CMV infection and cochlear implant

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Cytomegalovirus is the cause of the most common intrauterine virus infection. In the first trimester of pregnancy, the transmission rate of CMV infection is low (35%) and rises to 73% in the third trimester. About 90% of congenitally infected children are asymptomatic after birth. In the remaining, 10% symptoms are obvious at birth or manifest during childhood. Sensorineural hearing loss is the most common complication of cCMV infection and occurs in 10–15% of infected children. Thus, CMV accounts for approximately 25% of all cases with neonatal nonhereditary hearing loss.
The benefit of cochlear implantation for hearing rehabilitation in patients with cCMV infection has already been proven in comparison with reference groups.

Magnetic resonance imaging (MRI) plays a fundamental role in the decision-making process prior to cochlear implantation (CI).

The range of structural changes vary from ventricular dilatation, white matter gliosis, atrophy, parenchymal and ependymal cysts, or calcification to cortical malformations, especially polymicrogyria.

It is unclear whether the extent of structural changes identified on MRI can serve as a prognostic marker concerning CI outcome.
Objectives

- To investigate the role of congenital cytomegalovirus (CMV) infection on the improvement of speech perception and intelligibility after cochlear implantation (CI).
STUDY DESIGN

• The design of the study is a retrospective single-institutional chart review (2005-2017), performed in a tertiary academic referral center.
Methods

Inclusion criteria

1. Congenital CMV infection on cerebral magnetic resonance imaging (MRI)
2. > 24 months of CI experience;
3. device use throughout the day;
4. inclusion in an auditory-verbal (AVT) rehabilitation program;
5. normal hearing parents;
and
6. a monolingual Italian-speaking family.
<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Mean (standard deviation)</th>
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<tbody>
<tr>
<td>Age at Diagnosis (m)</td>
<td>8.6 (+/- 11.06)</td>
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<tr>
<td>Age at first amplification (m)</td>
<td>9.2 (+/- 10.5)</td>
</tr>
<tr>
<td>Age at CI activation (m)</td>
<td>38.6 (+/-30)</td>
</tr>
<tr>
<td>Stimulation modality</td>
<td></td>
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<tr>
<td>Monolateral CI</td>
<td>11</td>
</tr>
<tr>
<td>Bilateral CI</td>
<td>4</td>
</tr>
<tr>
<td>Follow-up</td>
<td>74.8 (+/- 48)</td>
</tr>
<tr>
<td>Gender</td>
<td>6 M</td>
</tr>
<tr>
<td></td>
<td>9 F</td>
</tr>
<tr>
<td>Anti-viral therapy</td>
<td>13 yes</td>
</tr>
<tr>
<td></td>
<td>2 no</td>
</tr>
<tr>
<td>Psychomotor disabilities</td>
<td>3</td>
</tr>
<tr>
<td>Cognitive Delay</td>
<td>5</td>
</tr>
</tbody>
</table>
Methods

• Minimal invasive surgery with RW insertion
• All patients had full insertion of the array
• No peri- and post-operative complications

• Evaluation tools:
  • CAP (Categories of Auditory Performance)
  • SIR (Speech Intelligibility Rating)
Methods


<table>
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<tr>
<th>Grade I (mild):</th>
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<tbody>
<tr>
<td>Few white matter abnormalities, defined as patchy lesions found either in up to three lobes, or, if found in all four lobes, lacking extensive or confluent spread. No neuronal migration disorder or microcephaly was present</td>
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<th>Grade II (moderate):</th>
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<tr>
<td>Extended white matter abnormalities, defined as patchy white matter found in all four lobes: frontal, parietal, temporal, and occipital, and, in addition, extended or confluent white matter involvement in at least one lobe (mostly parietal) present; no additional migration disorders</td>
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<th>Grade III (severe):</th>
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<tbody>
<tr>
<td>Migration disorders as polymicrogyria and pachygyria or present heterotopias or a marked microcephaly, regardless of the extent of white matter involvement</td>
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</tbody>
</table>
Results

MRI findings
Results

CAP

Follow-up

CAP

Follow-up
Results

SIR

(pre-ic 1m 3m 6m 12m 24m 36m 48m)

(pre-ic 1m 3m 6m 12m 24m 36m 48m)
CAP vs MRI Grade

CAP 12 m

CAP 24 m

CAP 36 m

p .01
SIR vs MRI Grade

SIR 12 m

SIR 24 m

SIR 36 m
Conclusions

• 13 out of 15 children achieved satisfactory results overall in speech perception and production for the respective follow-up times.

• Children with motor and cognitive delay were significantly slower to develop speech perception and intelligibility after CI compared with children without additional handicaps.

• The benefit of CI can not be predicted solely based on the severity of MRI findings.

• Auditory performance and speech intelligibility after CI in children affected by cCMV infection are determined by multiple factors and do not solely correlate with the severity of cerebral MRI lesions.
References