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Case Report

Speech and Language Characteristics of A Child with Congenital Left Hemisphere Atrophy: A Case Report

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Abstract

The effect of congenital left hemisphere deficit on speech and language skills remains unclear. The aim of this study was to describe the speech and language skills of a case with left hemisphere atrophy in the prenatal period. 4-year eight-month-old boy case's receptive and expressive language skills were analysed by Turkish Early Language Development Test (TEDİL) and language sampling analysis, oral-motor skills by oral motor assessment, and speech intelligibility by Intelligibility in Context Scale-Turkish (ICS-TR). It was found that the case's receptive language skills were below average, expressive language skills were weak, mean length of utterance (MLU) in words 1.08, MLU in morphemes 1.31, the family-reported score on the ICS-TR was 2.71 (maximum 5) and oral-motor skills were normal. The results of this study support that speech and language disorders may be observed in children with congenital left hemisphere deficit in the prenatal period.

Keywords: Congenital Brain Injury, Left Hemisphere Atrophy, Speech, Language.

Konjenital Sol Hemisfer Atrofisi Olan Bir Çocuğun Dil ve Konuşma Özellikleri: Olgu Sunumu

Öz

Konjenital sol hemisfer hasarının dil ve konuşma becerileri üzerindeki etkisi belirsizliğini korumaktadır. Bu çalışmanın amacı, prenatal dönemde sol hemisfer atrofisi olan bir olgunun dil ve konuşma becerilerini betimlemektir. 4 yaş 8 aylık bir erkek olgunun alıcı ve ifade edici dil becerileri Türkçe Erken Dil Gelişim Testi (TEDİL) ve dil örneği analiziyle, oral-motor becerileri oral motor değerlendirmeyle, konuşma anlaşılabilirliği ise Bağlam İçi Anlaşılabilirlik Ölçeği-Türkçe (BAÖ-TR) ile incelenmiştir. Olgunun alıcı dil becerilerinin ortalama altı, ifade edici dil becerilerinin zayıf, sözcüklerde ortalama sözce uzunluğunun (OSU) 1.08, biçimbirimlerde OSU'nun 1.31, aile tarafından raporlanan BAÖ-TR skorunun 2,71 (maksimum 5) ve oral-motor becerilerinin normal olduğu tespit edilmiştir. Bu çalışmanın sonuçları prenatal dönemde konjenital sol hemisfer hasarı meydana gelen çocuklarda çocuklarda dil ve konuşma bozukluklarının görülebileceğini desteklemektedir.

Anahtar kelimeler: Konjenital Beyin Hasarı, Sol Hemisfer Atrofisi, Konuşma, Dil

INTRODUCTION

Congenital brain lesions are associated motor, neuropsychological and behavioral problems (Riva et al., 2013). As the left hemisphere is associated with language skills, one of the areas where problems may be observed in congenital left hemisphere deficits is language skills (Feldman et al., 2002). One theory regarding the effect of congenital left hemisphere damage on language development is that in early left hemisphere lesions, the right hemisphere or other unaffected regions compensate for language functions (Raja Beharelle et al., 2010). This is thought to result in near-normal language development in children with congenital left brain deficit. However, the literature findings on this subject contain controversial results (Newport et al., 2022; Raja Beharelle et al., 2010). In a study of long-term language outcomes in adolescents and young adults with congenital left hemisphere damage, participants were found to have activation in their right hemisphere during language-related assessments, indicating that the brain may reorganise (Newport et al., 2022). However, in a study examining the language skills of school-age children

with left hemisphere damage who had a stroke in the perinatal period, it was found that children with left hemisphere damage had weaker receptive and expressive language skills than those in the control group (Ballantyne et al., 2007). The results of our study are expected to contribute to the controversial literature on whether the specialisation of language skills in the left hemisphere begins in the prenatal period. The purpose of this study was to describe the speech and language abilities of a case who had left hemisphere atrophy in the prenatal period.

METHOD

Case

A 4-year eight-month-old boy's speech and language abilities were assessed in the pediatric therapy room on November 11, 2023, following his parent's application to the Cappadocia University Speech and Language Therapy Education, Practice and Research Unit. All assessments were conducted on the same day. Brain MRI demonstrated atrophy throughout the left hemisphere, enlargement in the left lateral ventricle, decreased number of sulci and gyri in the left hemisphere, and left cortical thickness and flattening in this case with left brain deficit in the prenatal period (Figure 1).

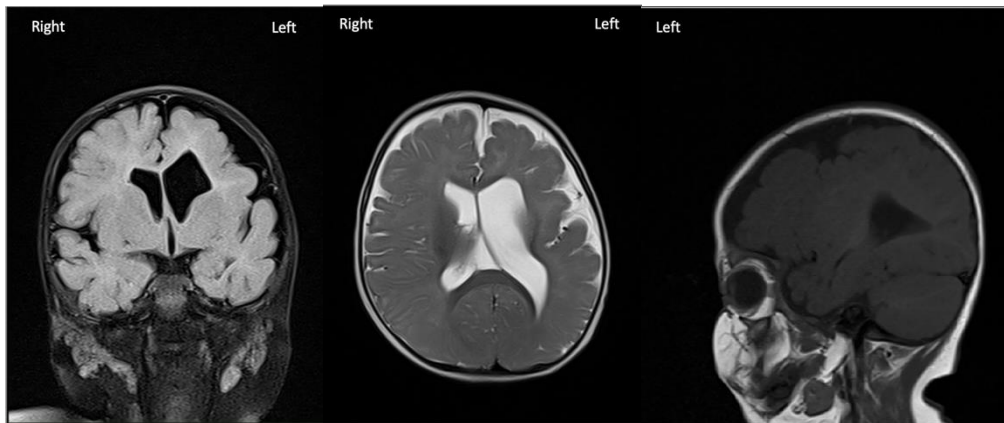


Figure 1. Brain MRI images of the case

The family consulted a paediatric neurologist at the age of 6 months because the case was using his right arm less since birth. As a result of MRI scan, it was found that the child had atrophy of the entire left hemisphere. The case has been receiving physiotherapy and rehabilitation for right side hemiparesis since 9 months of age. The case's hearing was tested at birth and no problem was detected. The eye examination of the case was examined recently and the case's eyes are healthy. The mother and father speak monolingual Turkish. When the pregnancy history of the mother was examined, the case was in vitro fertilisation and the gestational age of the mother was 29 years. During the pregnancy, the mother's health status changed from time to time, she had bleeding and had a stressful pregnancy process. The case has no siblings. The case had no history of

convulsions, epilepsy, drug use, chronic disease and genetic predisposition. According to the information given by the family, the case started babbling at the age of 9 months and uttered his first words at the age of 12 months. Between July 2022 and September 2022, the case received a total of 7 sessions of speech and language therapy by two speech and language therapists (other than the authors of this article). The family then discontinued speech and language therapy and continued to apply naturalistic language intervention strategies in line with the recommendations of the speech and language therapists (SLTs). At the time of the first SLT's assessment, the case had an approximate vocabulary of 10 words, communication with gestures and single words and no affix use. The case has been attending daycare 5 days a week since July 2022. The average screen exposure time of the case was around two hours per day, mostly on mobile phones.

Data Collection

The speech and language skills of the case were informally assessed by two SLTs, the first and second authors of this article, in a game with a kitchen theme. One of the difficulties encountered during the assessment was that the patient had difficulty manipulating objects in the informal assessment because he had right hemiparesis. For this reason, physical support was provided by SLTs when needed during the kitchen game informal assessment theme. The family was present in the room during the whole speech and language assessment process. In the informal assessment, it was observed that the case generally communicated at the single words, with gestures and rarely at the two-word level. It was found that the case occasionally struggled with naming abilities and he was able to comprehend simple instructions and responded appropriately to yes/no questions. The case's speech intelligibility was determined to be low during the informal evaluation.

In order to analyse the language sample during the game, a minimum of 50 utterances were recorded. The audio recording was transcribed and analysed with Systematic Analysis of Language Transcripts (SALT) software. MLU in words and MLU in morphemes were calculated. The results obtained were compared with typically developing Turkish-speaking children aged 4;5-4;11 years in the Turkish-SALT database (Acarlar et al., 2020). Turkish Early Language Development Test (TEDİL) was administered to evaluate the receptive and expressive language skills. TEDİL is a language assessment test designed for Turkish-speaking children between the ages of 2;0-7;11, assessing receptive and expressive language skills (Güven & Topbaş, 2014). After the TEDİL test, the case had an oral motor assessment by SLTs.

The case's oral-motor evaluation findings were normal. The speech intelligibility of the case was then assessed with the Intelligibility in Context Scale-Turkish (ICS-TR) based on family reports. ICS-TR is a five-point likert-type scale that assesses how intelligible the child's speech is to various communication partners (McLeod et al., 2012; Şanlı, 2022). ICS-TR has a total of 7 items. The maximum total score that can be obtained from the ICS-TR is 35 and the average total score is 5. High scores indicate better speech intelligibility. The whole assessment process was completed in 75 minutes.

Ethics

Ethical approval was obtained from the Non-Interventional Clinical Ethics Committee of Cappadocia University with the number E-64577500-050.99-58861, indicating that there were no ethical objections to the conduct of this study. The participant's family was informed in detail about the study orally and in writing, and they read and signed the Informed Consent Form.

RESULTS

The TEDİL results of the case are shown in Table 1.

Table 1. Results of TEDİL Language Assessment Test

	Standard Score	Percentile	Equivalent Age (years; months)	Comment
Receptive Language	89	24	4;1	Below average
Expressive Language	73	4	3;2	Weak
Verbal Language	77	6		Weak
Total Score				

According to Table 1, the case's TEDİL Receptive Language standard score is 89, and the percentile is 24, equivalent to age 4;1 (below average); Expressive Language standard score is 73, and the percentile is 4, equivalent to age 3;2 (weak); Verbal Language Total Score is 77 and the percentile 6 (weak). These results show that the case's receptive language skills are below the average of his peers. In addition, the case's expressive language skills were also found to be weak compared to his peers.

The case's MLU in words was 1.08, which was more than 3 standard deviation (SD) below the database mean of 2.73. Most frequently, the case used 1-word and 2-word utterances. The case's MLU in morphemes was 1.31, which was more than 3 SD below the database mean of 5.00.

The ICS-TR results of the case are shown in Table 2.

Table 2. Results of ICS-TR Speech Intelligibility Assessment Scale

Do you understand your child?	Usually (4)
Do immediate members of your family understand your child?	Sometimes (3)
Do extended members of your family understand your child?	Rarely (2)
Do your child's friends understand your child?	Rarely (2)
Do other acquaintances understand your child?	Rarely (2)
Do your child's teachers understand your child?	Usually (4)
Do strangers understand your child?	Rarely (2)
Total score	19 (max. 35)
Average total score	2.71 (max. 5)

Table 2 shows that the case's ICS-TR total score was 19 (maximum 35) and that the mean total score was 2.71 (maximum 5). According to the ICS-TR results, the case's speech intelligibility was found to be low.

DISCUSSION

This case study provides insights into the development of speech and language in a child with congenital left hemisphere atrophy. Clinical and neuroimaging examination confirmed significant damage to the left hemisphere, occurring during the prenatal period. Although there is a large literature on the effects of left hemisphere damage on speech and language in adults, studies on the effects of congenital left hemisphere damage on speech and language development are limited. This case study supports theories that congenital left hemisphere damage may have relatively moderate-severe effects on speech and language acquisition.

Newport et al. (2017) examined the language skills of infants with left hemisphere stroke in the perinatal period when they became teenagers and young adults years later. In this study, right hemisphere activation was observed both in fMRI-based language tasks and in language skills; participants with left hemisphere stroke had similar language results compared to participants with right hemisphere damage and control group. Newport et al. (2022) examined adolescents' and young adults' language and cognition skills with left hemisphere stroke in the perinatal period and a healthy control group. In this study, it was found that the left hemisphere stroke group showed completely normal language skills in various language tasks, including sentence comprehension and word structure subtests. In our study, we found inconsistent findings with the results of these studies. It is thought that this may be due to the fact that the age of the case in our study was pre-school age and the brain reorganisation took place over time. Furthermore, since the left hemisphere of the case in our study had an atrophy throughout the entire left hemisphere, it is

thought that it may have an effect on the restriction of brain plasticity due to its lesion size. This literature and the results of our study may imply that the language development of our case can be boosted with interventions targeting speech and language skills.

This study has some limitations. Since our study was not a longitudinal study, we were able to present only the immediate speech and language skills of the case. Therefore, general information about the speech and language development of the case was obtained through the family. Another limitation of the study is that the pragmatic component of the language was not evaluated. It is recommended that long-term longitudinal studies be conducted to investigate communication, speech and language skills in cases with congenital damage to the left hemisphere.

CONCLUSION

To conclude, this case report provides insights into speech and language development in a child with congenital left hemisphere atrophy. While receptive language skills were below average, expressive language was more notably impaired. Performance on assessment measures of morphosyntax ability and speech intelligibility also revealed weaknesses, aligned with evidence of lingering difficulties in children with early left lesions. These findings reinforce the complexity of functional recovery and motivate continued investigation of neural and behavioral plasticity mechanisms underlying language development following early left brain lesions. Understanding how speech and language develop after early brain lesions stands to offer new insights into typical and atypical development, as well as guide speech and language intervention strategies.

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