Effect of preterm birth on morphosyntactic development

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Abstract

Background: Preterm children are at risk of deficits in language, including grammatical skills. The main purpose of this survey was to investigate whether Persian-speaking children born preterm differ in their morphosyntax ability compared to full-term children.

Methods: Morphosyntactic performance was assessed in 86 Persian-speaking children (43 healthy preterm and 43 full-term children) aged 4 and 5 years using the Persian Developing Sentence Scoring (PDSS). Participants were matched for age, gender, and gestational age.

Results: The healthy preterm children who participated in this study were significantly outperformed by the full-term children in the morphosyntactic evaluation (p<0.05). Furthermore, their grammatical skills, based on PDSS, were not as developed as 4 to 5-year-old full-term children. Gender, in general, and gestational age had no effect on the PDSS scores of preterm children (p>0.05).

Conclusion: Preterm children, regardless of gestational age, are at risk of morphosyntax impairments, which may not be recovered during the normal development. Therefore, grammatical evaluation and treatment seem to be necessary for these children.

Keywords: Preterm children, Morphosyntax ability, NICU, PDSS, Language delay, Syntax

Introduction

Based on the World Health Organization definition (WHO), preterm is a baby born alive before 37 weeks of pregnancy are completed (1). According to guidelines of WHO, subdivisions of preterm birth include very preterm (births before 32 weeks of gestation), moderate preterm (births at 32 and 33 weeks of gestation), and late preterm (birth between 34 and 36 weeks of gestation) (2). Recent studies have revealed that every year an estimated 15 million babies are born preterm (3). The prevalence of preterm birth in Iran and Tehran is 9.2% and 30.4%, respectively (4, 5). There is strong evidence for neuropsychologic differences in the brain maturation of preterm children, as the central nervous system in these children is immature and has not developed normally (6). Also, preterm children have decreased cerebral volumes and smaller cortical surface area (7-10). Meta-analysis and review articles have documented that preterm children may face language development delays from the first year of life into adulthood (11-13).

Many studies have demonstrated that preterm children have difficulties in lexicon acquisition, word use, verb acquisition, syntax and morphology, reading, writing, spelling, and phonological processing (14-16). A longitudinal study on the development of lexicon and grammar in preterm children indicated that their problems would not be resolved by passing the time until adulthood (17). However, there is contradictory evidence regarding the language difficulties of preterm children (11, 18). This may be because language functions were examined in the early years of development in most studies, while advanced forms of language, including morphology and syntax, emerge after the age of 3 (19). Considering the fact that even the mildest language impairment in childhood may affect the quality of communication and education...
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achievement, early detection and intervention appear to be vital (20, 21). Furthermore, the prevalence of preterm birth is relatively high in Iran, and there are no studies on grammatical development in Persian-speaking preterm children living in Iran. As a result, the main purpose of this study was to examine the morphosyntactic development in Persian-speaking preterm children aged 4-5 years as assessed by the Persian Developmental Sentence Score tool (PDSS), adapted by Jalilevand et al (22).

Methods

A total of 86 Persian-speaking children aged 4-5 years participated in this cross sectional and comparative study in 2017. The sample included 43 healthy preterm children who were born before 37 weeks of gestation and 43 matched control group born full-term. The preterm children were a convenience sample recruited from a population of children discharged from the Neonatal Intensive Care Unit (NICU) at Firoozgar hospital in Tehran, Iran. The healthy control group, who were recruited from local kindergartens in Tehran, Iran were individually matched for age and gender with preterm children.

To exclude all children with developmental delays from this investigation, the parents were asked to complete the Age and Stage Questionnaire (ASQ-II). The questionnaire examines children's skills in communication, fine and gross motor, personal and social skills, and problem-solving. Total ASQ scores of children with the mother, father, and boys in the total score of PDSS (p>0.05) (Tables 1 & 2). The number of utterances was calculated based on the transcription conventions (Persian Transcription Convention Protocol: PTCP) considering the utterance (24).

The stability of morphosyntactic impairments at ages 4 to 5 was examined, showing that these impairments were not resolved during development. The mean development total score of PDSS was 1.18 in full-term children and 0.45 in preterm children (Fig. 1).
Discussion

The main purpose of this study was to examine morphosyntactic performance in 4-5-year-old preterm children born in Iran. According to the results, the Persian-speaking preterm children were outperformed by the control group on all of the Persian DSS (PDSS) subscores as well as the total score. However, there are some studies with the opposite results (25-28). These contradictory results might be due to language abilities being assessed in early years of development in most studies, while morphosyntax abilities, as an advanced form of language, emerge after the age of 3 (19). Our findings are consistent with numerous surveys supporting the negative effect of early birth on language development, specifically grammatical development (29-38). One possible reason for these problems could be found in the neural and functional plasticity of the brain. The presence of language impairments, particularly complex language functions, could be an indication for limitation of the plasticity of the developing brain born early and immature (13). Furthermore, based on the Schafer et al findings, the left frontal and bilateral temporal white matter volumes are considerably decreased in preterm children and neural pathways develop differently in these children. In addition, cortex development and establishment of neuronal connections mainly occur after 25 weeks of gestation (6, 39). These differences may illustrate possible reasons for morphosyntactic difficulties in healthy preterms.

Table 1. Demographic features of participants and PDSS scores

<table>
<thead>
<tr>
<th></th>
<th>PT (N=43)</th>
<th>FT (N=43)</th>
<th>PT (M,SD)</th>
<th>FT (M,SD)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Girl</td>
<td>46.5%</td>
<td>N=20</td>
<td>N=20</td>
<td>(9.24, 0.03)</td>
<td>(13.31, 0.44)</td>
</tr>
<tr>
<td>Boy</td>
<td>53.5%</td>
<td>N=23</td>
<td>N=23</td>
<td>(9.21, 0.03)</td>
<td>(12.86, 0.44)</td>
</tr>
<tr>
<td>Age (year)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>50%</td>
<td>N=21</td>
<td>N=22</td>
<td>(9,00, 0.891)</td>
<td>(12.499, 1.431)</td>
</tr>
<tr>
<td>5</td>
<td>50%</td>
<td>N=22</td>
<td>N=21</td>
<td>(9.451, 1.038)</td>
<td>(13.672, 1.704)</td>
</tr>
<tr>
<td>GA group (week)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FT (&gt;36)</td>
<td>N=43</td>
<td>50%</td>
<td></td>
<td>(13.072, 1.661)</td>
<td>(9.231, 0.984)</td>
</tr>
<tr>
<td>PT (&lt;37)</td>
<td>N=43</td>
<td>50%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LPT (34-36)</td>
<td>N=4, 9.3%</td>
<td></td>
<td></td>
<td>(9.51, 0.88)</td>
<td>(38)</td>
</tr>
<tr>
<td>MPT (32-33)</td>
<td>N=14, 32.6%</td>
<td></td>
<td></td>
<td>(9.47, 1.06)</td>
<td></td>
</tr>
<tr>
<td>VPT (&lt;32)</td>
<td>N=25, 58.1%</td>
<td></td>
<td></td>
<td>(9.05, 0.951)</td>
<td></td>
</tr>
</tbody>
</table>

Late Preterm (LPT), Moderate Preterm (MPT), Very Preterm (VPT), Gestational Age (GA), Preterm (PT), Full-term (FT)

Table 2. Comparisons of grammatical subcategories scores for Full-term and Preterm groups

<table>
<thead>
<tr>
<th>Grammatical subcategories</th>
<th>Full-term (M-SD)</th>
<th>Preterm (M-SD)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pronouns</td>
<td>(1.33-0.35)</td>
<td>(0.78-0.15)</td>
<td></td>
</tr>
<tr>
<td>Question words</td>
<td>(0.05-0.04)</td>
<td>(0.01-0.01)</td>
<td></td>
</tr>
<tr>
<td>Prepositions &amp; conjunctions</td>
<td>(1.71-0.27)</td>
<td>(1.15-0.37)</td>
<td></td>
</tr>
<tr>
<td>Verb morphology</td>
<td>(1.77-0.20)</td>
<td>(1.42-0.18)</td>
<td></td>
</tr>
<tr>
<td>Modal &amp; compound verbs</td>
<td>(1.01-0.49)</td>
<td>(0.36-0.08)</td>
<td></td>
</tr>
<tr>
<td>Grammatical morphemes</td>
<td>(3.75-0.48)</td>
<td>(2.29-0.52)</td>
<td></td>
</tr>
<tr>
<td>Sentence types</td>
<td>(1.13-0.19)</td>
<td>(1-0.01)</td>
<td></td>
</tr>
<tr>
<td>Sentence structures</td>
<td>(1.28-0.22)</td>
<td>(1-0.05)</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 1. Comparisons of morphosyntact abilities from 4 to 5 years for preterm and full-term groups
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more embedded clauses (two-verb sentence) at the age of 5.

Moreover, the relationship between the gestational age and the total score was examined, indicating no significant correlation between these 2 variables. Inconsistent with this finding, other surveys found a positive relationship between GA and language performance. Putnick et al suggested that very preterm children had poorer language performance than term-born and moderate-preterm children (37). Kern et al concluded that if the extremely preterm group were excluded from all preterm children, preterm children do not fundamentally differ from full-terms in their measures (40). One possible explanation is the focus on very preterm and moderate preterm groups and ignoring the late preterm children in many surveys. Cortex volume of a late preterm infant is 53% of that of a full-term infant, which means the last 6 weeks of gestation is very important for maturity of the brain (41-43), so the contradictory results of this study may be due to comparing 3 groups of preterm children. However, these results indicated that all preterm children, regardless of their gestational age, should be evaluated by a speech-language pathologist specialized in developmental language impairments.

The effect of gender on the morphosyntactic abilities of the participants was also analyzed. Although the PDSS total scores of girls were higher than boys in both groups of preterm and full-term children, this difference was not significant. However, girls were reported to have more advanced language abilities than boys in only 1 study (26).

An interesting by-product of our results was that there was no positive grammatical development in preterm children, while full-term children develop these skills increasingly from 4 to 5 years. Language impairment stability, also proposed by some studies, especially in very preterm children, is probably the result of general cognitive difficulties (37, 42, 44). Some studies have indicated that preterm children, similar to full-term children, demonstrate a general increase in language development (11, 18, 19, 28). However, the rate of development is slower in preterm children because of their limited brain plasticity. It appears that our findings have important theoretical and clinical implications and provide some new insights into the characteristics of morphosyntax development in preterm children. Therefore, it can be concluded that early detection and intervention of morphosyntactic difficulty in preterm children is vital since they are not likely to be recovered during development.

This study had some limitations. First, only those preterm children whose parents accepted to take part in the study were selected, and these parents might have had some prior concerns about their children’s language development. Second, this study was conducted only in 1 hospital in Tehran, Iran. Thus, the generalizability of the results was limited to preterm and term children born under similar conditions, which may present some selection bias.

Conclusion

In summary, this study suggested that morphosyntax performance was significantly lower in healthy preterms than in their full-term peers. Also, it was shown that all preterm children, regardless of their gestational age, should be assessed by a speech-language pathologist specialized in developmental language impairments and receive appropriate treatment for their morphosyntax deficits. In addition, it was found that the development of morphosyntax skill becomes stable in preterm children at ages 4 to 5.

Acknowledgments

First, I would like to thank children and parents for their participation in this research. Also, I must express my very profound gratitude to my family for providing me with unfailing support and continuous encouragement throughout my years of study and through the process of research and writing this thesis.

Conflict of Interests

The authors declare that they have no competing interests.

References


4. Karmiloff-Smith A. Nativism versus neuroconstructivism: Rethinking language abilities in preterm and full-term children born un-

5. Amini L, Mahmoudi Z, Hosseini F, Mahmoudi A. The relationship between the gestational age and the total score was examined, indicating no significant correlation between these 2 variables. Inconsistent with this finding, other surveys found a positive relationship between GA and language performance. Putnick et al suggested that very preterm children had poorer language performance than term-born and moderate-preterm children (37). Kern et al concluded that if the extremely preterm group were excluded from all preterm children, preterm children do not fundamentally differ from full-terms in their measures (40). One possible explanation is the focus on very preterm and moderate preterm groups and ignoring the late preterm children in many surveys. Cortex volume of a late preterm infant is 53% of that of a full-term infant, which means the last 6 weeks of gestation is very important for maturity of the brain (41-43), so the contradictory results of this study may be due to comparing 3 groups of preterm children. However, these results indicated that all preterm children, regardless of their gestational age, should be evaluated by a speech-language pathologist specialized in developmental language impairments.

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7. Ajaysi-Obe M, Saeed N, Cowan F, Rutherford M, Edwards A. Reduced white matter volume of preterm and full-term children, this difference was not significant. However, girls were reported to have more advanced language abilities than boys in only 1 study (26).

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