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The development of speech in early childhood in children from twin pregnancies with twin-twin transfusion syndrome (TTTS)

Abstract *The aim of the study was verifying, whether speech development is conditioned by a preterm birth, multiple pregnancy or pregnancy complicated with TTTS. We examined 52 preterm children, 15 of which were born after a single pregnancy and 42 after a multiple pregnancy. 23 children came from a pregnancy complicated by TTTS. The average age of the subjects was 32.5 months (SD=5.54). The research methods used in our study were as follows: analysis of medical documentation, a structured clinical interview and psychological conversation. Speech development of a child was assessed using BSID-III. An analysis of the results we obtained showed that there was a lower level of EC in the TTTS children in comparison to multiple-birth children without TTTS and single-birth children. We also found statistically significant relations between the EC scores and gender, age at the time of testing, disability, gestational age, birth weight.*

Key words*: TTTS; Speech development; BSID-III, twins, prematurity*

Introduction

In 2010 there were 415,000 live births in Poland, of whom 10,927 were twins (GUS, 2010). A steady increase can be observed in the percentage of multiple births, so much so, in fact, that the phrase "epidemic of multiple pregnancies" is sometimes used (Kornas-Biela, 2010). For example, in 1990 there were 5,267 children born from twin pregnancies, as compared to 8,328 in 2005 and 9,743 in 2008. Indeed, many researchers anticipate that by 2050 every second pregnancy will be multiple (Malinowski & Koszada, 2003). This increase in the frequency of multiple pregnancies results primarily from the development and availability of medical techniques to support reproduction ("Assisted Reproductive Technology," or ART) in the treatment of infertility (including the use of drugs to stimulate ovulation, artificial insemination with sperm from the husband or donor, in vitro fertilization, micromanipulation of ova and embryos, and preimplantation diagnosis), which in turn increase the chances of a multiple pregnancy (up to 50% higher probability of a twin pregnancy in such cases). Other factors include the changing human environment and the increasing age of primiparae (Benson & Doubilet, 1991; Kornacka, 2003; Pawelczyk & Derwich, 2003; Poręba & Poręba, 2003; Bielawska-Batorowicz, 2006; Bidzan, 2010). A multiple pregnancy, however, bears with it a higher risk of obstetrical and neonatological complications: it has been estimated that the mortality and morbidity rates in the postnatal period are 8 to 10 times higher in multiple pregnancies than in single pregnancies (Powers & Kiely, 1994). The high perinatal mortality rate in multiple births is caused primarily by premature birth: the statistics clearly indicate a high risk of premature birth in this group. In Poland, almost 7% of all children born in 2010 were born before the 36th gestational week, while the percentage in the case of twins is presently about 50%, and in the case of triplets, 90% (Kornacka & Sonczyk, 2008). Moreover, 5,798 twins (i.e. about 50%) were born with a birth weight under 2500 g. This figure is rendered significant by the fact that low birth weight is one of the main predictors of deficits in the physical and psycho-physical functioning of children at later stages of their development (see: Chrzan-Dętkoś & Bogdanowicz, 2007; Bidzan et al., 2010). Prematurity is not only the most common cause of death in neonates, but it also causes long-term health problems in the immediate post-natal stage, in infancy, and even for the

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rest of the person's life, due to the immaturity of basic life systems (Czajka, 2009). Among the most common of these are respiratory problems, disorder of the visual and auditory apparatus, and cerebral palsy (Kułakowska, 2002). Preterm children constitute a risk group for the occurrence of disturbances, deficits, disharmonies, or delays in development, or even disability (Wielenga et al., 2009).

In the case of multiple pregnancies, there are also other, specific risk factors. Among these is twin-twin transfusion syndrome (TTTS). This problem, which can occur in a monozygotic, monochorionic pregnancy, involves the abnormal transfer of blood to one fetus, the "recipient," from the other, the "donor." It is caused by imbalanced blood flow between the fetuses through the blood vessels of the placenta, which fuse the circulatory systems of the two children, causing one child to receive too much blood, and the other, too little. TTTS occurs in two forms: acute (18%) and chronic (82%) (Malinowski & Ropacka, 2003). TTTS is dangerous for the fetuses, since about 80% of cases end with the death of both children, while those children who do survive present with developmental abnormalities resulting from brain damage. The most effective treatment is to use a laser beam to close the communicating vessels in the placenta, which increases the children's chances of survival to 70% (Preis et al., 2010). Selective laser photocoagulation of communicating vessels (SLPCV), if correctly performed, and if the children survive the early postoperative adaptation period, most often leads to resolution of all symptoms of TTTS within about one week after surgery (Świątkowska-Freund et al., 2005). The first center in Poland (and presently one of two) to perform SLPCV is the Department of Perinatology in the Obstetrics Clinic at the Medical University of Gdansk, with which all the authors of the present study are now cooperating.

Despite general interest in the cognitive and psychosocial functioning of twins, there are only isolated publications on children with TTTS. The research on children from multiple births has focused on the specific nature of psychomotor development in children from multiple pregnancies as compared to children from single pregnancies (Bieleninik et al., 2010). When comparing these two groups of children it is essential, of course, to control for the modifying impact of prematurity on their level of functioning. Thus it seems most appropriate to analyze the developmental profile in particular domains among children born prematurely from single pregnancies and twin pregnancies, with or without TTTS.

As previously mentioned, premature birth is associated with developmental abnormalities in many different domains. However, the development of speech seems to deserve particular attention, especially in the case of twins. Speech is most often defined as the act of using language in the process of communication. This definition points to a wide spectrum of potential problems in this domain. The difficulties may involve both linguistic and communicative performance. Research in the genetics of behavior has indicated that genetic factors play a basic role in linguistic competence (Dediu, 2012), but the role of environmental factors in the shaping of linguistic functions should also be emphasized. The role of genes and the influence of factors modifying development, such as premature birth or serious illness in early childhood, must also be taken into account when searching for the causes of linguistic deficits (Bishop et al., 2006). Longitudinal research has shown that there is a specific dynamic in the roles played by genetic and environmental factors in the development of language at various stages in the child's life. A research group led by Hayiou-Thomas (2012) found that the environment plays the dominant role in the earliest stages of the child's development. In middle childhood, then, the role of genetic factors increases parallel to that of environmental stimulation. These data would appear to be essential in relation to the population of preterm children, and twins in particular. Many authors have called attention to the level of development of such verbal skills as vocabulary, the ability to express oneself in words, the formulation of sentences, and the comprehension of the surrounding world, which is lower in preterm children (Chrzan-Dętkoś & Bogdanowicz, 2007). Thus early stimulation of children born prematurely is absolutely essential, in order to minimize developmental deficits in this group of children. It should be emphasized that the increasing role of genetic factors in middle childhood (up to age 12) coincides with the period of the most intensive education, when it becomes apparent that a child has learning difficulties associated with specific language impairment (SLI) or developmental dyslexia, both of which have a largely genetic base (see Lipowska, 2011; Czaplewska, 2012). Support for the development of speech and language in preterm twins also affects another aspect of their functioning: twins are raised in a specific environment, in which the process of communication involves not only the parents or older siblings, but also the twin sibling, who is at very nearly the same stage in the development of speech (Viding et al., 2003). There is a considerable amount of research on the role of the strong bond that exists between twins, which seems to limit their need for contact with other children, as well as adults, which, in the absence of proper stimulation, has a negative impact on the dynamics of development in the intellectual-cognitive and social domains (Bryan, 2003). Particular attention should be drawn to the so-called "secret language of twins," not to be confused with SLI, since it does not result from deficits in respect to linguistic competence, but results from the unique communicative situation that arises in the twin-twin dyad. In most cases, the developmental delays are evened out as the twins come to have more contact with other children, for example in childcare, preschool, etc. (Bidzan et al., 2010).

Material and methods

The multiplicity of factors that can modify the development of speech in children born from twin pregnancies and the role that early stimulation can play in this process motivated us to undertake research on the differences in the level of speech development between children born prematurely from multiple or single pregnancies. In addition, we decided to investigate the differences in the group of twins born from a pathological pregnancy, i.e. one with TTTS. The question was this: whether or not it is the very fact of premature birth, or the fact that a child was born from a multiple pregnancy with a normal or abnormal course, that is most essential in shaping the development of speech.

For this purpose we examined 58 preterm children (33 girls and 25 boys), divided into three research groups:

Group I: children from a single pregnancy (N=15, 25.9%);

Group II: children from a multiple pregancy without TTTS-related complications (N=20, 34.5%);

Group III; children from a multiple pregnancy with TTTS-related complications (N=23, 39.7%).

When tested these children were in early childhood, so that the average age was 32.5 months (SD=5.54). Statistical analysis performed using the Kruskal-Wallis rank test indicated no statistically significant difference at baseline in respect to the children's age among the three groups (χ^2=0.474, p=0.789).

Most of these children (N=40) were born by cesarian section. The majority (N=44) had assumed the normal head-down position at birth, 6 were breech, and 7 were transverse. The research group was not homogeneous in respect to gestational age, birth weight interval, head circumference, Apgar scores at 1 and 5 minutes, and final Apgar scores. The distribution of gestational age, birth weight interval, the 1-minute and 5-minute Apgar scores, and the final Apgar scores for the respective research groups are shown in Figs. 1-3.

There were children in this group who were born in the 26th gestational week, and others who were born in the 36th gestational week (Fig. 1). The Kruksal-Wallis rank test indicates that the distributions do not differ among the three research groups (χ^2=0.474, p=0.789). There are also no differences when comparing the twins with or without TTTS (χ^2=0.254, p=0.615).

The majority of these children had a birth weight below 2500 g, including 3 with an unusually low birth weight (ILBW), and 4 with an extremely low birth weight (ELBW). Only 10 of our subjects had a birth weight over 2500 g.

An analysis of variance (ANOVA) failed to show any significant differences among the three groups of children in terms of average birth weight (F=1.84, p=0.17, see Fig. 2). However, a comparison of the birth weight intervals (Fig. 2) using Pearson's χ^2 test indicates that the research groups do differ from each other in this respect (χ^2=18.6, p=0.013).

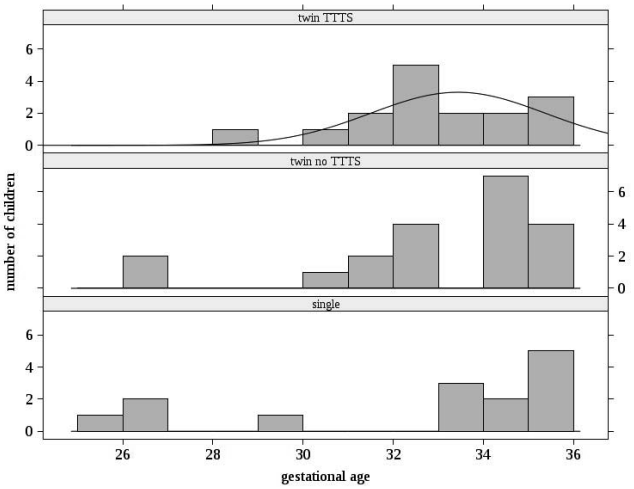


Fig. 1. The distribution of gestational age for the entire research population

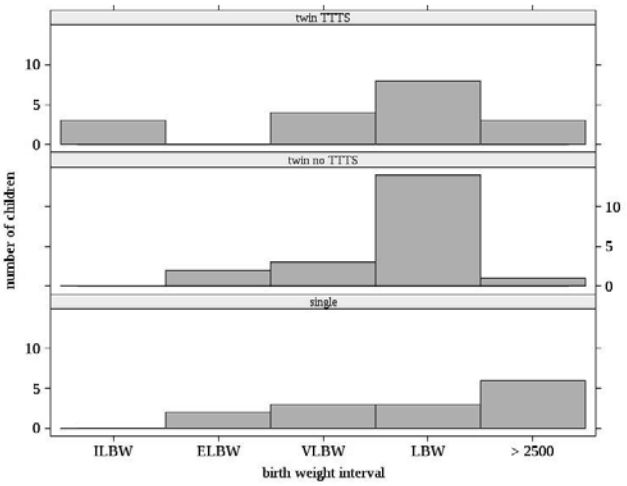


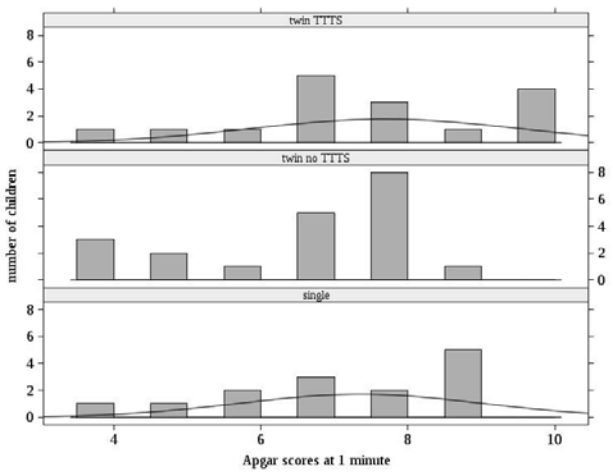
Fig. 2. The distribution of birth weight interval for the entire research population

The average head circumference was 31.1 cm (SD=4.17); the smallest was 23 cm, and the largest was 47 cm. The average length at birth was 44.6 cm (SD=5.71); the shortest child was 31 cm long, while the longest was 60 cm long. The chest circumference was similarly differentiated: the average chest circumference was 27.5 cm (SD=3.75), and ranged from 18 cm to 34 cm. An analysis using the Kruksal-Wallis rank test did not find any significant inter-group differences in terms of this parameter (χ^2=0.421, p=0.81), nor were there any significant differences between the twins with TTTS and those without (χ^2=0.413 p=0.52).

The children we examined differed in respect to the one-minute, five-minute, and final Apgar scores (Fig. 3 A-C).

It should be pointed out that 5 children had a one-minute score of 4, while in the final scores none of them had less than 5 points. Four children had 5 points at one minute, while 2 had 5 points in the final score, whereas a score

A



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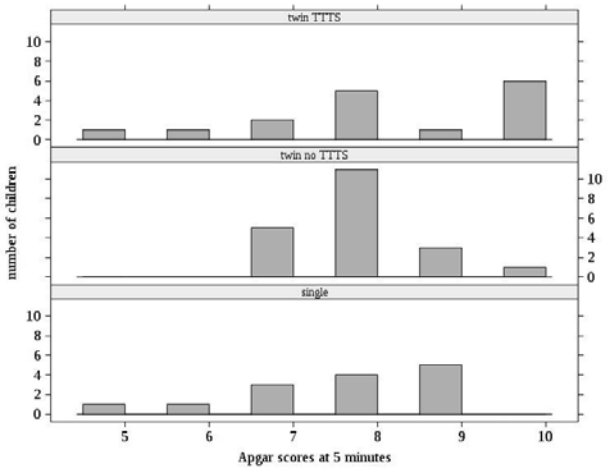

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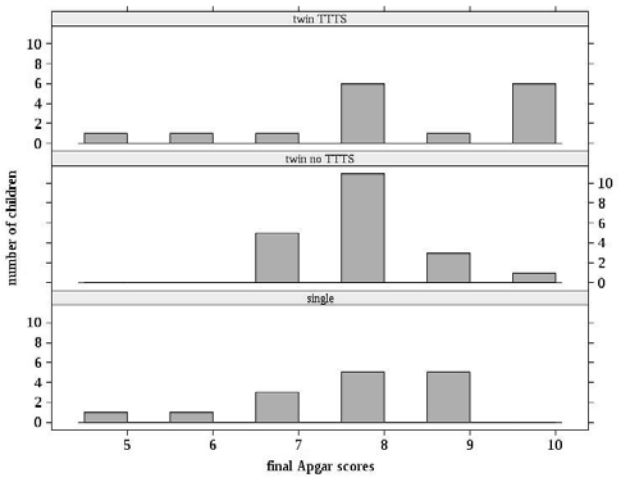

Fig. 3. The distribution Apgar scores at 1 minute (A), 5 minutes (B) and final (C) for the entire research population

of 10 was achieved by only 4 children at one minute and only 7 in the final score. The majority of these infants had 7 or 8 points at one minute (12 each), and 24 had a final Apgar score of 8. A comparison of the three research groups in terms of Apgar scores using the Kruksal-Wallis rank test indicates no inter-group differences in the 1-minute (χ^2=.99, p=0.37), 5-minute (χ^2=1.69, p=0.43) and final Apgar socores (χ^2=2.43, p=0.296). A comparison of the twins with and without TTTS using the Mann-Whitney-Wilcoxon test also confirms no significant differences in 1-minute (U=122, p=0.22), 5-minute (U=128, p=0.29), or final Apgar scores (U=120, p=0.181).

Four of our subjects were officially recognized as disabled: two of them had cerebral palsy (including one with tetraplegia), one had multiple disability and hearing impairment, and one child had Pierre Robin syndrome, which manifests in low muscle tone. A further two children were chronically ill (one child with a heart defect and one with dwarfism, cleft prepuce, testicles in the scrotum), but were not officially disabled. Four of these six children were from the TTTS group, one was from a single pregnancy (multiple disability and hearing impairment), and one (cerebral palsy with tetraplegia) from a twin pregnancy not complicated by TTTS.

The research methods used in our study were as follows:

1. analysis of medical and nursing documentation pertaining to the course of the pregnancy (including the type of pregnancy: single or multiple, brought to term or premature), birth (cesarian section or physiological birth), fetal position at birth, perinatal condition, anthropometric parameters at birth (Apgar score, gestational age, birth weight, length at birth, head circumference, chest circumference);
2. a structured clinical interview and psychological conversation;
3. The Bayley Scales of Infant and Toddler Development, Third Edition (BSID-III), which are used not only to describe the child's development, but also in the diagnosis and planning for possible treatment and psychological rehabilitation of children with developmental delays or disability. At present this is the diagnostic tool most commonly used to evaluate early development, in both clinical practice and scientific research (Stoińska-Montgomery, 2003; Kornacka, 2003b; Anderson et al., 2010). One advantage of the BSID-III is the fact that it is the only scale designed to examine children born prematurely, since it incorporates an age correction for preterm children. The BSID-III tests the child's psychomotor development in respect to cognitive functioning (Cognitive, Cog), motor skills (Motor, Mot), and language skills (Language, Lang). In the present study, given the research goals, we used only the language skills subtest, which consists of two scales: Receptive

Communication (RC), which checks the child's ability to comprehend and react appropriately to verbal commands, and Expressive Communication (EC), which measures the ability to use speech.

Results

The children we examined obtained Language Scale (Lang) scores that placed in every score interval, from extremely low to very high (Fig. 4). The distribution of results was similar in the Receptive Communication (RC) and Expressive Communication (EC) subscales. Most of the children scored average or above average.

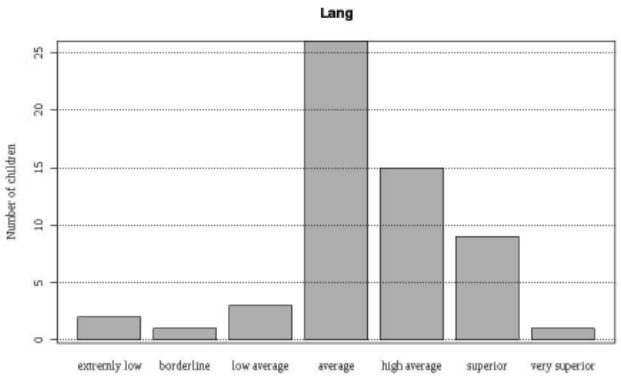

Fig. 4. Distribution of results from the Language Scale (Lang) by intervals

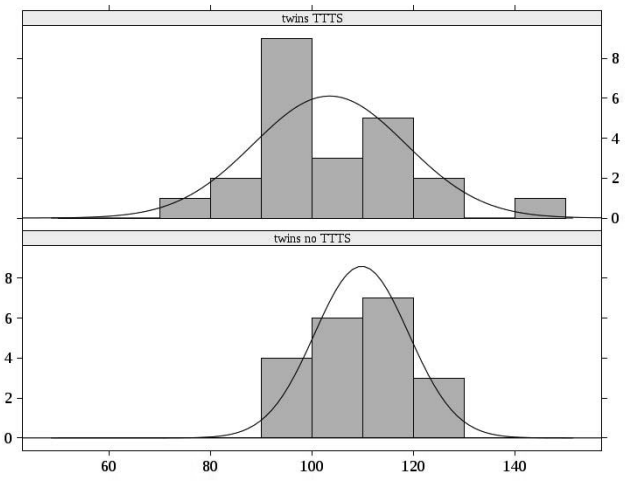

Fig. 5. Comparison of Lang results from the TTTS children

When the TTTS children were compared to the others (Fig. 4), it became clear that the Lang results were somewhat different. Most of the TTTS children obtained average scores (90-100), while most of the children in the non-TTTS group had above average scores (110-120). This difference was not, however, statistically significant.

Although this group included the children with the lowest scores, a statistical analysis using the Kruksal-Wallis rank test indicated that the difference was not statisically significant; however, there was a clear trend (χ^2=3.68, p=0.055) towards lower scores in the TTTS children.

Figure 6 shows the results (in score intervals) obtained in the Lang scale for the children with or without TTTS.

The group of preterm children was also differentiated in respect to the RC (Fig. 7) and EC subscales (Fig. 8).

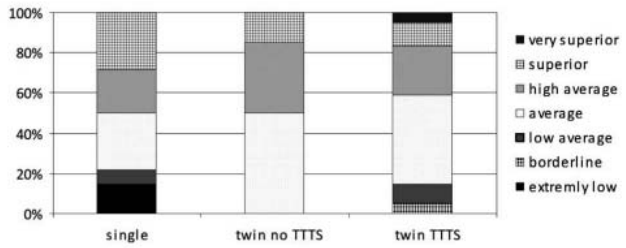

Fig. 6. Distribution of score intervals in the Language Scale (Lang) in the research population

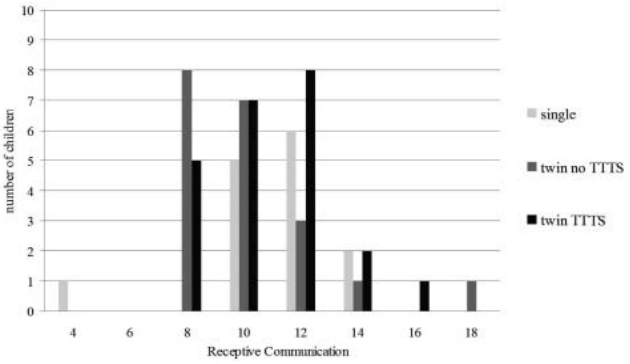

Fig. 7. Differentiation of preterm children in respect to the Receptive Communication (RC) subscale

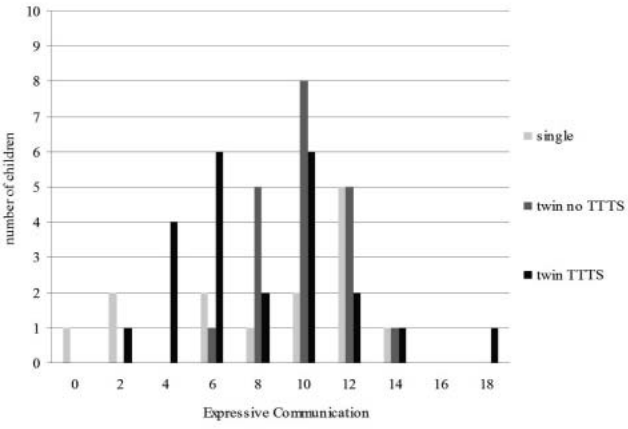

Fig. 8. Differentiation of preterm children in respect to the Expressive Communication (EC) subscale

Regarding the possible correlations between the overall Lang results and the biomedical parameters, there were statistically significant differences ($p<0.05$) in respect to the child's gender, gestational age, birth weight, birth weight interval, and disability.

For the purposes of our research, the distribution of results in the Lang scale was particularly important. Our analysis revealed statistically significant differences in the distribution of Lang results between genders ($p=0.025$; higher scores in girls), gestational age (Pearson's $r=0.25$; $p=0.043$; the higher the gestational age, the higher the Lang score), disability (Mann-Whitney-Wilcoxon's $U=19$; $p=0.003$, lower scores in disabled children) and birth weight intervals (Kendall's $\tau=0.191$; $p=0.04$).

An analysis using the Mann-Whitney-Wilcoxona test for independent samples indicates that there are differences between the children with and without TTTS ($U= 152$; $p=0.028$). The TTTS twins more often fell in the ILBW and VLBW intervals.

In the case of Receptive Communication (RC) there were statistically significant differences in relation to disability (Mann-Whitney-Wilcoxon's U for independent samples =29; $p=0.007$), birth weight interval (Spearman's rank $\rho=0.234$; $p= 0.049$), 5-minute Apgar score (Pearson's $r=0.28$; $p=0.025$), and final Apgar score ($r=0.27$; $p=0.03$).

Interestingly, TTTS showed a significant relation only with the results in the Expressive Communication (EC) subscale.

An analysis of the results we obtained showed that there was a lower level of EC in the TTTS children in comparison to multiple-birth children without TTTS and single-birth children ($F=4.83$; $p=0.034$).

We also found statistically significant relations between the EC scores and gender ($F=4.19$, $p=0.05$, with higher scores for girls), age in months at the time of testing ($r=0.22$; $p<0.05$; the EC score increases with age), disability ($F=12.7$, $p=0.001$; disabled children had a lower

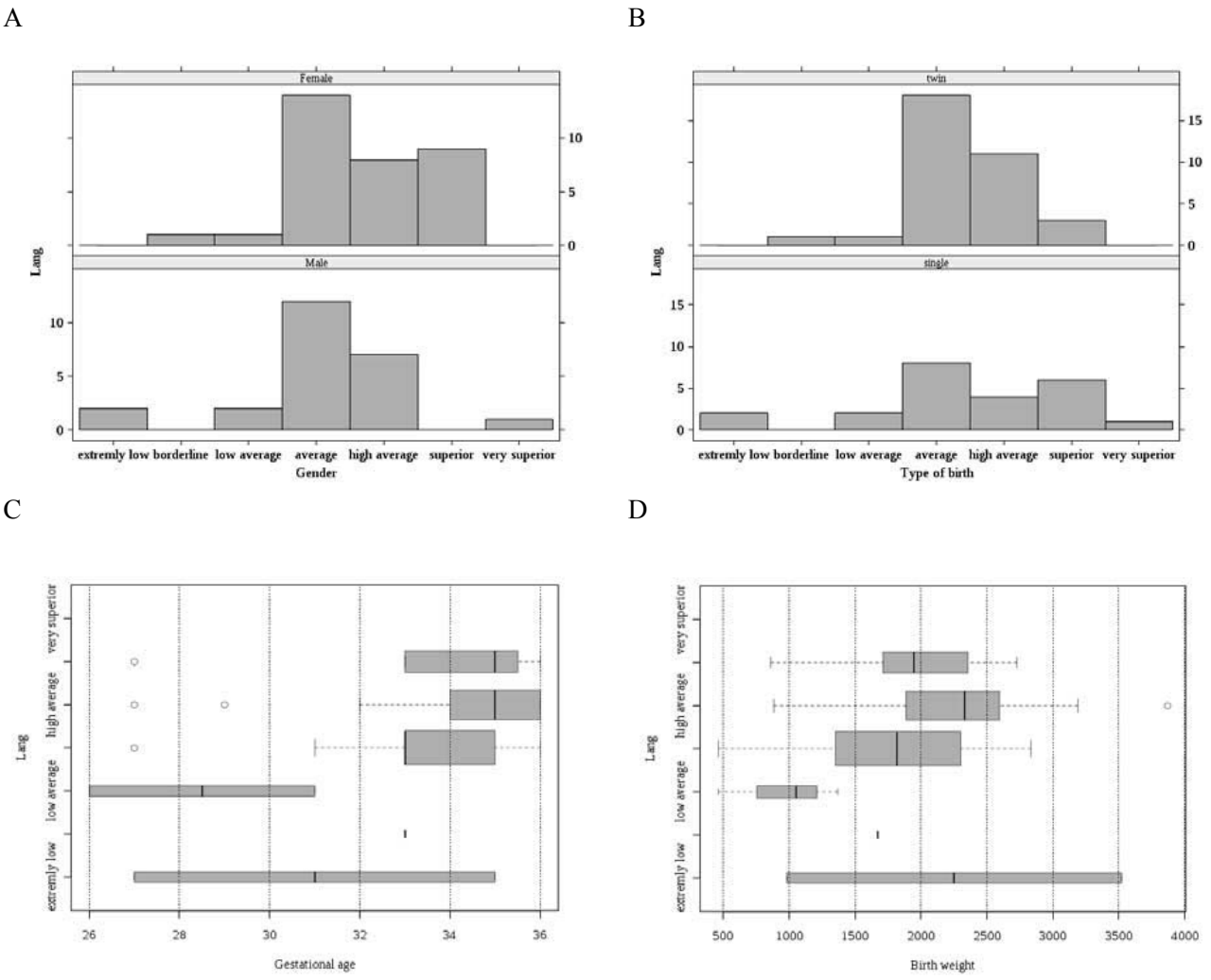

Fig. 9. Distribution of Language Scale (Lang) results between genders (A), single vs. twin (B), gestational age (C), birth weight (D)

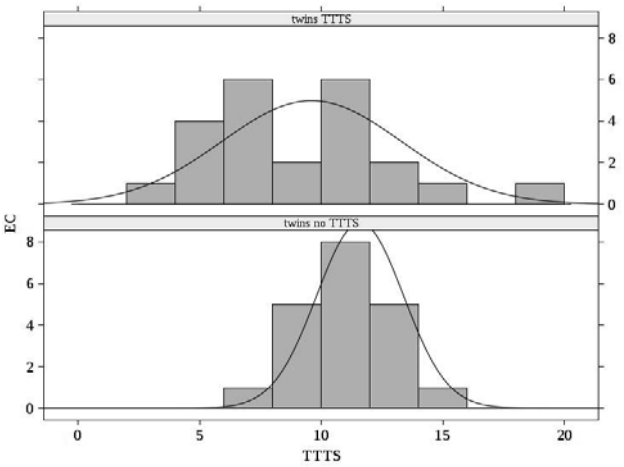

Fig. 10. Results obtained by children with and without TTTS in the Expressive Communication (EC)

EC score), gestational age (r=0.26; p=0.03; the higher the gestational age, the higher the EC score), birth weight (r=0.294; p=0.01; the higher the birth weight, the higher the EC score); birth weight interval (ρ=0.26; p=0.03), and chest circumference (r=0.289, p=0.02; EC score higher as chest circumference increases).

Discussion

Much of the research in the literature on children born prematurely confirms the results we obtained. Preterm children are a high risk group for slower development in terms of language skills. There have been only a few reports, however, on the development of speech in TTTS children. There are only preliminary reports from Poland: a study conducted in 2008 by Bidzan et al. (2010) and Preis et al. (2010), in which the development of speech in 9 children (who constituted at that time 100% of the 2.5-3-year-old children in Poland born from monozygotic, monochorionic pregnancies with TTTS, who had been operated prenatally with SLPCV) was analyzed using the speech subtest of the Pediatric Development Scale (Polish: Dziecięca Skala Rozwojowa, abbreviated DSR). The tasks contained in this test measured the specific reaction to speech in the environment, the tendency to mimic, and comprehension, along with spontaneous production of utterances (single words and phrases). The research showed that 5 of the 9 children (55.6%) were classified at a low level of speech development, while the remaining 4 children achieved average (2 children, 22%) and above average scores (also 2 children, 22%).

The correlations we found between the biomedical parameters - gender, age, gestational age, birth weight, head circumference, disability, and type of birth (single or twin) - are also confirmed in the literature. It can be inferred, then, that both premature birth and multiple pregnancy affect the development of speech.

It is appropriate to include the biomedical parameters in this analysis, since they are almost universally acknowledged to be predictors of the psychomotor functioning of preterm children at later stages of development. There are indications of problems in children with low birth weight (< 1500 g), who not only vocalize less in infancy, but also show a smaller vocabulary, use shorter sentences, and have greater problems in comprehending verbal content than do children of the same age who were carried to term (Huber et al., 1993). Likewise, in research on a population of 441 2-year-old children (corrected age), including 221 with ELBW and a gestational age lower than 28 weeks, and 220 children carried to term with a normal birth weight (2449 g or more), the preterm children were found to have significantly lower scores on the BSID-III in respect to cognitive, linguistic, and motor functions, while development delays in language skills were found in 21% of the preterm children. Many researchers have shown that not only birth weight, but also gender, social risks, and perinatal factors are significant factors in predicting neurological disturbances and problems with cognitive and motor functions (Stoelhorst et al., 2003; Laptook et al., 2005; Woodward et al., 2006; Chrzan-Dętkoś et al., 2008; Treyvaud et al., 2009). A meta-analysis performed by Bhutta et al. (2002, cited by Sondaar et al., 2008) indicated that the IQ of preterm children of school age was lower by as much as 10 points in comparison to the control group, while its value was determined by gestational age and birth weight. Polish research by Bidzan et al. (2008) on preterm children at age 10, using the Wechsler Intelligence Scale for Children, found that the preterm children did not differ significantly from children carried to term in terms of overall intelligence. Moreover, there were no statistically significant differences in respect to verbal intelligence, but such differences did occur in nonverbal intelligence: the preterm children had lower scores in this respect. At the same time, preterm children were found to have significantly lower scores on two subtests of the Wechsler Intelligence Scale: Vocabulary and Puzzles. Similar results have been reported by Kennell & Marshall (1982), Korzon et al. (1998), Bowen et al. (2002), Bohm et al. (2002), and Vollmer et al. (2006). The research done by Wolke et al. (2008) regarding the language-related problems of children born very prematurely indicated that, although these children have a significantly lower level of linguistic functioning, this is rather the effect of a global cognitive deficit, and SLI should not be diagnosed in these cases. The premise that the level of cognitive functioning plays a moderating role on language skills in preterm children has also been confirmed by Magill-Evans et al. (2002), who found lower verbal function on the Wechsler Intelligence Scale in healthy 10-year-olds born prematurely. However, the importance of developmental delays in speech has been emphasized in Polish research by Chlebna-Sokół et al. (2003), who found that over half of the 4-7-year-old children they examined had developmental delays

in intellectual development and/or disturbances in a range of cognitive functions. The lower IQ scores are the reason for the unrealistic measurement of intelligence in preterm children, which, according to Bielicka-Cymerman (2003) is associated with the disharmony of psychomotor development, and in particular with the marked developmental delays in speech

While there can be little doubt, then, that premature birth per se has a significant effect on the development of speech, it is not so clear that multiple birth has such a moderating effect. Particular attention should be drawn to the results of the TTTS children, since they could be affected by as many as three types of factors: premature birth (with all its consequences), multiple birth, and TTTS, which is a very serious complication of pregnancy.

The results of our research allow us to draw several conclusions of practical importance for rehabilitation, which can be useful for interdisciplinary teams working with children born prematurely, including those with TTTS complications, and their families.

In the first place, it should be emphasized that preterm children are at risk for:

- pathologies in the period of adaptation to extrauterine life;
- abnormal development (Stoińska & Mongomery, 2003);
- disturbances, deficits, or disharmonies in development (Kmita, 2003; Anderson & Doyle 2003; Davis, 2003; Saigal et al., 2003; Wielenga et al., 2009), including the development of speech.

Our analysis of the nursing and medical documentation regarding these preterm children confirmed the internal differentiation of the group we examined, as well as the occurrence of complications characteristic for children born prematurely. When classifying these children to a risk group (based on the classification proposed by Stoińska & Montgomery, 2003) for purposes of rehabilitation, the following parameters should be borne in mind:

- gestational age less than 37 weeks;
- low or extremely low birth weight;
- Apgar score less than 5 at five minutes after birth;
- neonatal complications characteristic for premature babies, including respiratory distress syndrome, pneumonia, infection, bronchopulmonary dysplasia, necrotizing enterocolitis, persistent pulmonary hypertension of the newborn, patent ductus arteriosus, periventricular leukomalacia, periventricular/intraventricular hemorrhage, apnea, anemia, hypoxia, hyperbilirubinemia, hypoglycemia, or TTTS.

Given the risks associated with premature birth, children during their first years after birth required highly specialized, interdisciplinary care and various forms of stimulation of speech, as well as motor and cognitive development. The choice of therapy for early support of the child's development depends on both the etiological factors causing the particular developmental problems and the child's individual growth tempo (Chrzan, 2007). It should be emphasized that it is not just the child, but the entire family that needs help, since it must cope with both the trauma associated with premature birth and the threat to the infant's life, and the long-term consequences of premature birth.

Rehabilitation should begin in the neonatology ward. The range of medical care for the premature child in neonatology departments causes medical intervention to be seen very often as a medical problem (Łuczak-Wawrzyniak et al., 2010). The primary aim of specialists is first of all to maintain the newborn's life, monitor vital functions and treat disturbances, and then, when the "growth period" begins, to implement programs of early stimulation and support for development (Zawitkowski & Bartochowski, 2000; Stoińska & Montgomery, 2003). Numerous specialists have emphasized that children from the risk groups require not only specialized care in intensive therapy, but also thorough specialized observation until at least age 2 (corrected) (Kornacka, 2003), age 3 (Stoińska & Montgomery, 2003), or even age 8 (Kornacka, 2003), which points up the long-term aspect of the prognosis for the child's development (Kowalczykiewicz-Kuta, 2008). An analysis of these children's state of health in early childhood points to the necessity to provide care for preterm children; only in the group we studied 4 children were already officially declared disabled, of which 2 had cerebral palsy, 1 had multiple disability (hearing impairment and cerebral palsy), and one had Pierre Robin syndrome and low muscle tone. The occurrence of cerebral palsy in preterm children is proof that these children belong to the high risk group for neurodevelopmental disorders (see, for example, Finnstrom et al., 1998; Kania, 2008). Although, as previously mentioned, there are numerous reports in the literature concerning the psychomotor development of preterm children, as well as their emotional development (Lis, 1979; Payne, 2002; Brisch et al., 2003; Hoff et al., 2004; Clark et al., 2008; Spittle et al., 2009) and behavioral disturbances (e.g. Kmita, 2003; Wielenga et al., 2009), and there has also been research on the psychomotor development of preterm children from multiple pregnancies (e.g. Chrzan-Dętkoś et al., 2008; Chrzan-Dętkoś & Bogdanowicz, 2010), still, there have been no previous studies of the development of speech in TTTS children. Thanks to progress in neonatology, it is now possible to save children born in the 23rd gestational week (Rutkowska et al., 2010), and even the 22nd (Oishi et al., 1997, cited by Rijken et al., 2003), though these newborns, when they survive, are burdened with a high number of neurological complications. This has directed the interest of psychologists to the problem of the future functioning of preterm children, the mother-child relation, and the way these children are perceived by their parents.

For rehabilitation psychology, the research results reported by Bieleninik (2012) may be important, in that

they emphasize the impact of premature birth on the often differing perception of these children by their mothers, as compared to children carried to term, in many spheres in early childhood. This is exceptionally important for psychologists, considering the persistence of the biomedical moderators shaping this perception even three years after birth. The very fact that these children have been classified to a risk group causes changes to take place in the way they are perceived by their parents (Bielawska-Batorowicz, 1995). In the case of children born prematurely, this perception may be grounded in one or both of two mechanisms: the prematurity stereotype (see Bielawska-Batorowicz, 1995; Piekarska, 2005) or the vulnerable child stereotype (Hendrickson, 1998), which has been described in the literature as parental perception of the child's vulnerability (PPCV; see Samra et al., 2010). It is these children, who have experienced acute, potentially life-threatening illnesses in very early life, who can be perceived by their parents as "delicate" long after they are no longer impaired. As specialists have indicated, the perception of psychomotor development within the framework of the prematurity stereotype can have a negative impact on the child's development (Piekarska, 2005). Stern & Karraker (1990) and Kearsley (1979) have also introduced the concept of iatrogenic retardation, caused by the methods used to raise the child. The prematurity stereotype, which refers to a negative set of conviction concerning the premature child and affecting the mother's behavior, can affect the child's development (Piekarska, 2005). The perception of the child as less mature, physically weaker, less socially adept, with cognitive deficits, causes the mother to become overly protective (Macey & Harmon, 1987) and insufficiently attentive to what the child actually needs (Scheye et al.,1998, cited by Stern et al., 2000); these mothers are more controlling, passive (Forcada-Guex et al., 2006), and convinced that their child is very fragile, weak, and helpless, and so in need of protection (Piekarska, 2005). At the same time it has been observed that preterm children are less sensitive to their parents' behavior (Davis et al., 2003), display less attentiveness, and show fewer positive emotions, a lower level of activity, less interest in exploring their environment, and a tendency to cling to their mothers (Field, 1987). Thus the mothers of preterm children must be more alert to their reaction and more active in their contact with them (Bakeman & Brown, 1980, Beckwith & Cohen, 1978, Crnic et al., 1983, DiVitto & Goldberg, 1979, Field, 1977, 1979, cited by Field, 1987). Other studies (e.g. Miles & Holditch-Davis, 1997) indicate that the parents of preterm children who have reached the age of 3 years still display a parenting attitude that can be called "compensatory parenting," consisting in increased stimulation and attention, overprotectiveness, and difficulty in setting boundaries. This kind of parenting results from perceiving the child as being "special" in certain respects and "below average" in others.

Twins born prematurely face different conditions for development in their environment, both in the prenatal period (see Rostowski, 2010) and after birth (Leonard & Denton, 2009; Gomółka-Walaszek, 2008). Their development in all domains, including language, is affected by a combination of three factors: genetic, shared environment, and non-shared environment (Deater-Deckard et al., 2001; Bolton et al., 2006; van Hulle et al., 2007). Attention has recently been drawn to the role of mirror neurons in the development of these domains, from the prenatal period into childhood (Rostowski, 2010).

Given the psychological consequences of premature birth, it is not only the children born prematurely who are at risk, but also their parents. Awareness of the etiology of premature birth and the complications of this period, such as TTTS, can be useful in overcoming unnecessary stress and excessive care for the child, and can strengthen the mother-child bond. Gravem et al. (2009) have also shown that understanding the perception of preterm children by their mothers in the neonatology department is an essential element in nursing intervention, which should be directed towards teaching the parents to care for the premature child, and to perform some exercises independently at home. Kmita (2002) argues that the support offered by medical personnel can be limited by such factors as the lack of a suitable place and sufficient time for conversation, the lack of conversation skills, and the use of medical language the parents are unable to understand. Difficult family circumstances can also make it hard to provide proper support. This provides yet more evidence for the argument that a psychologist should be on staff in pathological pregnancy and neonatology wards (Brisch et al., 2003; Fegran et al., 2008). The role of the family environment should also be stressed in respect to the child's compensatory capacities in the early phase of development (Brazelton, 1995, cited by Kmita, 2002).

After discharge from the hospital, premature infants should remain under the care of hospital-based clinics for newborn pathology, ophthalmological and neurological clinics, and other specialists as needed. Regular medical check-ups are essential in the future to maintain the child's functioning at an optimal level. In addition to interdisciplinary medical care, the children are also assessed psychologically: some of them may require stimulation of their cognitive development and cooperation with a speech therapist or neurologopedist. Such care is provided in Poland by Early Intervention Centers and Early Support Centers. The basic idea of psychological help for infants and small children is "turning to the family": engaging the family in the program of early support and taking into consideration the fact that the family and the child are in a dynamic process of development and change. In Early Intervention Centers the level of the child's current mental development is assessed, and play strategies are introduced, stimulating the child to assure complete, relatively harmonious development and

compensate for any developmental delays. Psychomotor development, including language skills, is assessed on the basis of observation of the child, an interview with a parent, and a developmental diagnosis for small children, using such instruments as the BSID scale used in the present study, the Brunet-Lezine Psychomotor Development Scale, the Cattell Psyche Scale to test infant intelligence, and the Child Development Scale (DSR).

One of the consequences of immaturity is delayed motor development in the first months of life, so some children require rehabilitation of the motor system, which also supports the development of speech. The degree to which the development of speech is delayed depends on the degree of prematurity, and is most severe in children with ILBW and ELBW (i.e. a birth weight under 1000 g) and in children born before the 30th gestational week; these factors are associated with complications, such as TTTS and disability.

The indications for rehabilitation include psychomotor development more than three months behind the corrected age and abnormal muscle tension. Research done by Szymańska (2000) and standard neurological testing of preterm children born before the 32nd gestational week, conducted in the 40th week of biological age, indicate that premature infants differ significantly from newborns carried to term in respect to posture and muscle tension, both passive and active. In preterm children, Szymańska (2000) observed more frequent occurrence of asymmetrical posture, accompanied by reduced active muscle tension (hypotonia) in the axial muscles of the trunk. This may also have an effect on the development of speech in these children. Thus preterm children, including those born from multiple pregnancies and those with TTTS, should be treated with physiotherapeutic methods, which are intended to help only abnormally low or abnormally high muscle tension, but also the development of speech. Neurologopedic intervention can commence as early as post-natal hospitalization, provided the child's state of health allows for this. This is all the more important when we recall that reversing the child's incorrect habits becomes more difficult after a certain time, and may even prove impossible. Early rehabilitation - bearing in mind the increased percentage of children with cerebral palsy in the "extreme" premature group - is also essential for the reason that - according to the Vojta-Prechtel method of evaluation - the symptoms can be observed in the first weeks of the infant's life, when it is often easier to prevent or overcome them. On the other hand, in the rehabilitation of infants the recurring question in determining the etiology of the possible developmental problems is whether the symptoms are momentary difficulties or serious disturbances that can cause chronic changes in the child's later development (Zawitkowski, 2003). The author points out that the label "former preemie" can cause two unjustified reaction: on the one hand, excessive stimulation and rehabilitation of the child, and on the other, postponing these activities on the assumption that the child has plenty of time to acquire further skills.

In Poland there are primarily two methods used in the rehabilitation of infants and children: the Vojta method and the NDT-Bobatch method, both of which are well described in the literature. A detailed description would exceed the bounds of the present study.

To sum up: the disharmonious development of speech in preterm children points to the necessity to compensate for deficient skills as part of rehabilitation programs in early childhood, such as early support of development. Especially because premature birth, not multiple birth or TTTS per se, seems to be the main predictor of deficit in speech development.

Psychological intervention is necessary, but so is neurologopedic intervention in neonatology departments, in order to minimize the traumatogenic effects of premature birth, especially in the case of infants with low gestational age, extremely low birth weight, a long period of adaptation to extrauterine life, or complications of the adaptation period.

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