Adaptation period of the first and second twin – comparative analysis of somatometric, biochemical, and clinical parameters

Paweł Krajewski¹, Maria Kwiatkowska¹, Jarosław Kalinka², Anita Chudzik¹, Małgorzata Pokrzywnicka¹

Abstract
The aim of the study was to analyze and then compare somatometric, biochemical, and clinical parameters between the first and the second baby in twin deliveries. Material and method: Hospital medical records for all deliveries in the Department of Perinatology, Medical University of Łódź, Poland, between January 2006 and December 2008 were reviewed. The study population consisted of 88 live-born pairs of twins. Subjects were divided into two groups. Group one comprised all first and group two all second twins. McNemara and Wilcoxon tests were used to compare variables between groups. Results: The mean birth weight of the second twins group was significantly lower (2176 g) as compared to mean birth weight of first twins (2295 g), \(p = 0.049\). Except for the mean birth weight, which was higher in the group of first twins, other somatometric features did not differ significantly between the groups. Mean Apgar score was significantly lower \((p = 0.017)\) in the group of second twins (6.9 vs 7.2) while arterial blood gas parameters obtained from the umbilical artery after delivery were not significantly different between both groups. First twin was more likely to be diagnosed with sepsis, congenital pneumonia and hyperbilirubinemia, and respiratory distress syndrome and hypoglycaemia developed more often in the second twin, but the difference was not statistically significant. Mortality rate for the entire study population was 5.1%. The mortality rate was higher among second twins as compared to first ones: 7.9 % vs 2.3 %, respectively. Conclusions: First twin had significantly higher birth weight and higher Apgar score. There was no difference in occurrence of major morbidities between the first and second twin. The mortality rate was higher in the group of second twins.

Key words: twins, somatics, clinical disorders, mortality

Introduction
One of the consequences of the introduction of the novel techniques in the treatment of infertility is higher rate of multiple gestations, and as results an increased number of high risk pregnancies, and higher number of complications concerning both mothers and babies [13, 16, 19, 23, 25, 26]. One of the most important complications of multiple gestations is increased risk of preterm delivery. Obstetrical decision about the mode of the delivery in a multiple pregnancy is required [23, 26] which should take into account the potential health hazards for the mother and/or the newborns [8, 12, 20, 26]. Since the problems associated with the adaptation period are related not only to the mode of delivery but also to the gestational age at birth, delivery via cesarean section does not totally eliminate the risk of those complications [12, 25, 26, 28]. High morbidity and mortality of the newborns observed in the multiple pregnancies is tightly bound to prematurity [23, 25].

Aim of the study
The main purpose of the study was to evaluate and compare the postnatal condition of the first and second twin.

Material and methods
Retrospective review of the hospital medical records for all deliveries in the Department of Perinatology, Medical University of Łódź, Poland, between January 2006 and December 2008 was performed and 88 live-born pairs of twins were selected as a study population. Subjects were divided into two groups with first twins assigned to group one, and second twins to group two. Information regarding maternal age, length of gestation, mode of delivery as well as data pertaining to selected somatometric and clinical parameters of the adaptation period of the first and second twin was collected retrospectively from the delivery room records, newborn nursery medical records, and from neonatal intensive care unit charts.

Recorded information included: first minute Apgar score, cord blood gas parameters (from umbilical artery), hematocrit in the first 24 h of life, newborns’ birth weight (BW), head circumference (HC), total body length and size of the fontanel. The frequency of clinical complications during adaptation period, such as sepsis, congenital pneumonia, respiratory disorders requiring ventilatory support, necrotizing enterocolitis (NEC), hypoglycemia, anaemia, pathology of the central nervous system, and retinopathy was also recorded and analyzed.

The McNemara test was applied for the analysis to compare the frequency and the Wilcoxon test to compare the medium values of the paired observations.

Results
Between January 2006 and December 2008 4949 newborns were born alive in the Department of Perinatology, Medical University of Łódź, Poland. Among those born alive

¹ Division of Neonatology, Department of Perinatology, I Chair of Obstetrics and Gynecology, Medical University of Łódź, Poland
² Medical and Environmental Pregnancy Health Hazards Unit, Department of Perinatology, I Chair of Obstetrics and Gynecology, Medical University of Łódź, Poland
there were 176 (3.56%) babies from twin pregnancy. 61.4% of twin pregnancies were high risk and required hospitalization. Majority of twin mothers were below 30 years old (68.2%) but 1/3 of them were older than 30 years old. The first twins were delivered by cesarean section in 85.2% of cases while second twins in 88.6% cases as some of the patients in the group of the second born twins had to be delivered via caesarean section after spontaneous vaginal delivery of the first twin. Among twins from study population 37 pairs of twins were term and 51 (57.9%) were born prematurely. The mean gestational age of the term and preterm twins were 37.7 and 33.5 weeks, respectively. There were 99 males and 77 females in the studied group.

Apgar scores, cord blood gas values and hematocrit in the first 24 h of life for both twins are presented in Table 1.

Table 1. Comparison of the Apgar score, arterial blood gas values, and hematocrit, between first and second twins born in the years 2006-2008

<table>
<thead>
<tr>
<th>Postnatal condition parameters of the twins</th>
<th>Apgar score</th>
<th>Arterial blood gas (umbilical artery)</th>
<th>Hematocrit (HCT) in the first 24 h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Medium (range)</td>
<td>Medium (range)</td>
<td>Medium (range)</td>
</tr>
<tr>
<td>First twin</td>
<td>n = 88</td>
<td>7.2 (1-10)</td>
<td>7.24 (7.0-7.4)</td>
</tr>
<tr>
<td>Second twin</td>
<td>n = 88</td>
<td>6.9 (1-10)</td>
<td>7.23 (7.0-7.33)</td>
</tr>
<tr>
<td>p</td>
<td>0.017</td>
<td>0.204</td>
<td>0.368</td>
</tr>
</tbody>
</table>

The mean Apgar score was significantly higher among first twins (7.2) as compared to group of second first twins (6.9), p = 0.017. Base deficit (BE) was non-significantly higher in the group of second twins. There was no difference in mean pH between both groups. There was no significant difference between first and second twins in mean hematocrit (HCT) determined in the first 24 h of life.

The selected somatometric parameters of the twins are presented in Table 2. The mean birth weight of the first twins was 2295 g, with the smallest newborn weighed 600 g. The smallest newborn in the second group weighed only 230 g. The mean birth weight for the second twins group was significantly lower (2176.9 g) as compared to mean birth weight of first twins (p = 0.049).

Table 2. Selected somatometric parameters of the first and the second twins. Total length, vertex-sacral length (SI), and head circumference were not significantly different between the group of first and second twins

<table>
<thead>
<tr>
<th>Somatometric parameters of the first and the second twin</th>
<th>Birth weight (g)</th>
<th>Total body length (Total cm)</th>
<th>Verteb Sacral SI (cm)</th>
<th>Head circumference (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium (range)</td>
<td>Medium (range)</td>
<td>Medium (range)</td>
<td>Medium (range)</td>
<td></td>
</tr>
<tr>
<td>First twin n = 88</td>
<td>2295 (600-3520)</td>
<td>48.57 (33-60)</td>
<td>29.43 (18-38)</td>
<td>31.88 (22-36)</td>
</tr>
<tr>
<td>Second twin n = 88</td>
<td>2176 (230-3500)</td>
<td>48.51 (33-57)</td>
<td>29.44 (19-39)</td>
<td>31.71 (23-37)</td>
</tr>
<tr>
<td>p</td>
<td>0.49</td>
<td>0.911</td>
<td>0.938</td>
<td>0.417</td>
</tr>
</tbody>
</table>

Table 3 A. Selected clinical parameters of the adaptation period in the first and the second born twins

<table>
<thead>
<tr>
<th>Inborn infection</th>
<th>Inborn pneumonia</th>
<th>RDS</th>
<th>TTN</th>
<th>Mechanical ventilation</th>
<th>NEC</th>
<th>Hyper-bilirubinemia</th>
<th>Hippo-glicemia</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>First twins n = 88 (100%)</td>
<td>20</td>
<td>22.7</td>
<td>11</td>
<td>12.5</td>
<td>8</td>
<td>9.1</td>
<td>3</td>
</tr>
<tr>
<td>The second twins n = 88 (100%)</td>
<td>17</td>
<td>19.3</td>
<td>9</td>
<td>10.2</td>
<td>11</td>
<td>12.5</td>
<td>1</td>
</tr>
<tr>
<td>p</td>
<td>0.157</td>
<td>0.414</td>
<td>0.157</td>
<td>0.157</td>
<td>0.655</td>
<td>0.564</td>
<td>0.132</td>
</tr>
</tbody>
</table>

Table 3 B. Selected clinical parameters of the adaptation period in the first and the second born twins

<table>
<thead>
<tr>
<th>Anaemia</th>
<th>PDA</th>
<th>CNS Pathology</th>
<th>ROP</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>The first twins n = 88 (100%)</td>
<td>22</td>
<td>25.0</td>
<td>5</td>
</tr>
<tr>
<td>The second twins n = 88 (100%)</td>
<td>19</td>
<td>21.6</td>
<td>5</td>
</tr>
<tr>
<td>p</td>
<td>0.439</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Table 3 C. Selected clinical parameters of the adaptation period in the first and the second born twins

Comparison of first and second twin babies
Tables 3 A and 3 B presents the rate and the prevalence of selected clinical complications observed in the adaptation period among group of the first and second twins. Transient tachypnea of the newborn (TTN) was diagnosed more often in the group of first twins, while respiratory distress syndrome (RDS) in the group of second twins, but the difference was not statistically significant for either. The percentage of patients requiring assisted ventilation in the form of nasal continuous positive airway pressure (NCPAP) or intermittent mandatory ventilation (IMV) was non-significantly higher in the group of second twins. The mean duration of assisted ventilation was also non-significantly longer in the group of second twins (14.8) days vs 17.0 days in the group of first twins ($p = 0.655$). Patients in the group one were more often diagnosed with intrauterine infection, congenital pneumonia, hyperbilirubinemia, anaemia and necrotizing enterocolitis, while those in the group two were more commonly affected by hypoglycaemia, but the difference was not statistically significant. Intraventricular haemorrhage (IVH), periventricular leukomalacia (PVL), hypoxic ischemic encephalopathy (HIE), persistent ductus arteriosus (PDA), and retinopathy of premature (ROP) were rare complications occurring with similar frequency in both groups. There was one case of the intrauterine twin to twin transfusion syndrome (TTTS). 9 of 176 patients died with 7 deaths occurring in second group, and only 2 in first group. Mortality rate for the entire study population was 5.1 %. The mortality rate was higher among second twins as compared to first ones: 7.9 % vs 2.3 % respectively.

**Discussion**

Around 85% of twins in our study population were born via caesarean section (CS). As suggested by some authors delivery via CS in situation where both twins are in longitudinal position and head presentation may result in unexpected complications in perinatal period [14, 26]. Some reports indicate that cesarean section as the method of delivery in multiple pregnancy neither influence the outcome [16, 17, 26], nor has a positive effect on the general condition of both twins after the delivery [9, 17, 18]. It should only be advocated and performed for very specific indications [26]. Keyes et al. reported that in about 21.5% of cases the twin pregnancies have ended before 35 week of gestation [10]. In the study of Płoszyński et al. 40% of the twins were born prematurely [17]. In our study 60% of babies from twin pregnancies have been born before 37th weeks gestation.

There are reports suggesting that introduction of the new methods of assisted reproduction techniques and infertility treatment resulted in an increased number of multiple pregnancies in women at aged more than 30 years [23, 25, 26]. In our study 1/3 of twins mothers were older than 30 years old.

The Apgar score continues to be a useful tool for assessing the newborns’ state after the delivery. According to some reports in 5 to 10% of twins the 5 minute Apgar score is very low, between 0 to 3 points. The relationship between the mode of delivery and outcome of both twins is not clear. Piekarski et al. [16] reported that with the breech presentation the 5 minute Apgar score of the first twin is higher when delivered via CS as compared to spontaneous vaginal delivery. In the study of Prins et al. [18] the 5 minute Apgar’s score of the second twin was significantly lower than the score of the first twin. Similar observations were reported also by others authors [5, 17]. Jordan et al. noticed that also in the group of neonates with birth weight less than 1500 g the Apgar score of the second twin is lower when compared to the first twin [28]. In our study we have also found that the mean Apgar score was significantly higher among first twins (7.2) as compared to group of second first twins (6.9), $p = 0.017$.

Data from the literature suggest that the second twin is at higher risk for lower birth weight, lower Apgar score, and have higher rate of complications in the immediate postnatal period [11, 18, 25]. The risk of intrauterine growth restriction (IUGR) and low birth weight is from 5 to 7 times higher in multiple pregnancies [10]. Pregnant woman with twin gestation is 11 times more likely to deliver the baby with birth weight less than 1500 g when compared to women carrying single fetus [25]. Many reports suggests that lower birth weight is associated with worse prognosis, and second twin appears to be at a higher risk for intrauterine growth restriction [11, 18, 25]. The limited supply of nutrients and space restriction, but probably also the genetic factors are responsible for a poor intrauterine growth of twins in comparison with the singletons [17, 25]. One of the very important prognostic factors is weight discrepancy between dichorionic twins. In the study of Sebire et al. mortality rate for expectantly managed pregnancies was 24%, and 2.2 % of surviving twins were handicapped [21, 25]. Maternal hypertension and pre-eclampsia increases the risk of intrauterine growth restriction and growth discordance between twins [6]. Mortality and morbidity for the smaller twin increases significantly when weight discordance reaching 15-30 [25]. The most important prognostic factors in twin pregnancy are the birth weight and gestational age [25]. In our study the mean birthweight in the second twins group was significantly lower (2176 g) as compared to mean birth weight of first twins (2295 g); $p = 0.049$.

The delivery of the second twin is associated with a higher risk of obstetric and neonatal complications [17, 18, 26, 27]. In the study of Prins et al. intracranial bleeding and respiratory disorders occurred more frequently in the second twin [18]. Other authors reported 2-4 times higher frequency of RDS in the second twin [7, 10]. Similarly, Płoszyński et al. observed, that RDS and circulatory disturbances were diagnosed more often in the second twin [17]. The increased rate of RDS and greater number of days on ventilatory support in the group of second twins in our study seems to confirm those observations indicating that the ability of the respiratory system of the second twin to adopt to extraterine life is somewhat impaired.

Perinatal injury, apnea, and necrotizing enterocolitis are more frequently observed in the first twin [10, 18]. Prins et al. reported a remarkably high prevalence of perinatal injuries in the group of first twins with birth weight of 1250 to 1500 g [18].
Comparison of first and second twin babies

Prematurity accompanied by intrauterine infection is the most common cause of neonatal morbidity and mortality also in multiple pregnancies [13]. In the study of Dudkiewicz et al. the rate of intrauterine infections did not differ between twin one and two [5]. However, Ploszyński et al. [17] in their analysis found the rate of infection in the first twin to be higher when compared to second twin. Our results are in agreement with the study of Dudkiewicz et al. [5] when the rate of infection was slightly higher in the group of first twins but the difference was not statistically significant.

Some reports suggest that in comparison to singletons, the incidence of fetal congenital anomalies is much higher in twin pregnancies, and that the risk is increased even further for dizygotic twins [10, 25]. Anomalies of the central nervous system, gastrointestinal tract, genito-urinary and cardiovascular system are among the most commonly reported [25]. The presence of anomalies increases the risk of complications during the adaptation period and perinatal mortality [4]. In our study population there were 2 cases of congenital heart defect, 1 case of Down syndrome, 3 cases of genitor-urinary system anomalies, 2 cases of central nervous system anomaly and 1 case of duodenal obstruction.

Monozygotic twins are at increased risk for developing twin to twin transfusion syndrome [10, 25]. Only one twin pregnancy in our study was complicated by that complications.

Retinopathy of prematurity (ROP) is one the complications associated with preterm birth. In our study population the rate of ROP was not different between the groups – 3.4 %.

Despite recent advances in the obstetric and neonatal care perinatal mortality and morbidity in multiple pregnancies remains high [10,19]. Fetal and neonatal mortality is usually the result of the complications occurring either during the course of pregnancy or intrapartum at the time of labor and delivery. Preeclampsia, preterm birth, malpresentation, umbilical cord prolapse, prolonged second stage of labor, perinatal asphyxia, birth injury, and congenital infections are among those most frequently encountered [10, 19].

The mortality rate for twins is several times higher than that of single newborns [3, 4, 19]. Death of one twin increases significantly the risk of dying for surviving twin. It is estimated to be 9 times higher in the case of death of the first twin death and 11 times higher when the second twin dies [10]. Warner et al. [25] in their review examined the relationship between the low birth weight and mortality for twin and singleton pregnancies with inconclusive results. There are studies reporting lower, higher, and the same mortality rate for the twins when compared with singletons with comparable birth weight [25]. The 2000 g is accepted as the threshold birth weight above which the mortality rate decreases dramatically, while birth weight < 1500 g is associated with significantly increased risk of dying [19]. Since complications associated with preterm birth are one of the most important causes of increased mortality observed in twin pregnancies, the main efforts at improving survival of multiples should be directed toward decreasing the rate of preterm deliveries [19, 23, 26]. Some authors suggest that in cases of multiple pregnancies allowed to continue past 38 weeks placental insufficiency might be responsible for intrauterine fetal demise [1, 26]. Death of one of the fetuses complicates 3-4% of multiple pregnancies, and is a very serious obstetric problem [15, 22, 23]. We observed almost 3.5 times higher mortality rate in the group of second twins as compared to group one. Skubicki et al. reported similar observations and suggested that higher perinatal mortality in the group of second twins might be related to more frequent occurrence of malpresentation and higher rate of obstetric interventions which increases the risk of perinatal depression/asphyxia [23]. On the contrary Jallad et al. who analyzed 5’minute Apgar scores and perinatal mortality in twin pairs found no difference between the first and second twin [9]. Others also reported similar observations [24]. Intrauterine growth restriction of one of the twins increases mortality and risk of handicap for the surviving twin [21]. Congenital defects are often the cause of death [4].

The cognitive outcome of twins is the result of an interaction between genetic and environmental factors. For the high risk, premature patients, influences of the environment seem to be more important and are proportional to the degree of prematurity and presence of other complications. The role of genetics becomes more important with increasing gestation and decreasing acuity of the patient’s condition [11].

Conclusions

1. First twins had significantly higher birth weight in comparison with second ones.
2. Apgar scores in the group of second twins were significantly lower, which might be a reflection of worse general condition after delivery.
3. The incidence of major morbidities did not differ between the groups.
4. The mortality rate was higher in the group of second twins when compared to group one.

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