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Maternal-fetal characteristics, etiological factors and perinatal outcome in pregnancies with polyhydramnios

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Abstract

This study aimed to evaluate maternal and fetal characteristics, etiological factors and perinatal outcome in pregnancies with polyhydramnios. A total of 330 pregnancies diagnosed with polyhydramnios were included in this retrospective study conducted a tertiary center. Data on maternal age, obstetric characteristics, etiology of polyhydramnios, detailed prenatal ultrasonography findings on fetal anomaly, cesarean delivery and the adverse pregnancy outcomes were recorded. The polyhydramnios was idiopathic in 47.0% of cases, while the maternal diabetes (29.4%) and fetal conditions (23.6%) were responsible for the etiology in the remaining cases. The most common anomalies identified on prenatal ultrasonography were central nervous system anomalies (29.5%), followed by the gastrointestinal system anomalies (11.5%). Cesarean delivery occurred in 38.2% of pregnancies, while adverse pregnancy outcomes were noted in 64.5% of pregnancies and including delivery of a neonate with congenital anomaly (36.6%), macrosomia (21.1%), preterm delivery (18.3%), perinatal mortality (13.1%) and pregnancy termination (10.8%). In conclusion, our findings revealed the polyhydramnios to be idiopathic approximately in half of cases, and to be due to either maternal diabetes or fetal pathology (central nervous system and gastrointestinal anomalies) in the other half. Given the occurrence of adverse pregnancy outcomes in most of pregnancies with polyhydramnios, our findings emphasize the vital role of intensive monitoring of the maternal-fetal condition in pregnancies with polyhydramnios. Meticulous diagnostic approach seems crucial for timely recognition of fetal anomalies via detailed imaging studies as well as the early recognition and strict control of gestational diabetes via close follow up, given the likelihood of erroneously diagnosed idiopathic polyhydramnios to challenge the implementation of proper management and appropriate counselling of patients.

Keywords: polyhydramnios, etiology, amniotic fluid index, pregnancy outcome

1. Introduction

Polyhydramnios, a pathologic excess of amniotic fluid index (AFI) in pregnancy, refers to a high-risk obstetric condition with an incidence of 0.9-3.9% and increased risk of adverse pregnancy outcomes (1-3). Its association with increased perinatal morbidity and mortality depending on the extent of excess AFI and the underlying cause, necessitates antepartum evaluation and fetal surveillance to identify the underlying cause, direct care, and time the delivery (2, 4-7). Although the most of cases are idiopathic, polyhydramnios can also result from fetal (i.e., structural anomalies, aneuploidy) or maternal conditions (i.e., diabetes, infections) (2, 5, 7-9).

This study aimed to evaluate maternal and fetal characteristics, etiological factors and perinatal outcome in pregnancies with polyhydramnios.

2. Materials and Methods

2.1. Study population

A total of 330 pregnancies diagnosed with polyhydramnios were included in this retrospective study conducted at University of Health Sciences, Başaksehir City Hospital between May 2020 and December 2021. Pregnancies beyond the 20th week of gestation were included and those with polyhydramnios due to fetal conditions were further assessed via detailed prenatal ultrasonography for potential structural fetal anomalies.

This study was conducted in accordance with the ethical principles stated in the “Declaration of Helsinki” and approved by the institutional ethics committee (date of approval: 24.11.2021, protocol no: KAEK/2021.11.257).

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2.2. Assessments

Data on maternal age, obstetric characteristics, etiology of polyhydramnios (idiopathic, maternal diabetes, fetal conditions), detailed prenatal ultrasonography findings on fetal anomaly, cesarean delivery (rates and indications), and the adverse pregnancy outcome including preterm delivery (<37th gestational week), macrosomia (>4000 g birthweight), delivery of a neonate with congenital anomaly, perinatal mortality and pregnancy termination were recorded.

Polyhydramnios was diagnosed by two-dimensional ultrasound findings including the amniotic fluid index (AFI) > 24 cm or the single deepest pocket (SDP) > 8 cm, in addition to a 75 g oral glucose tolerance test (OGTT). A 75 g OGTT was implemented in routine pregnancy care between 24 and 28 weeks of gestation, as well as in women with polyhydramnios and a missing OGTT before 28 weeks of gestation, while after 28. gestational week the glycemic status was monitored via glycated hemoglobin (HbA1c) and blood glucose testing.

Fetal well-being after the diagnosis of polyhydramnios was monitored once or twice weekly, based on gestational week and presence of concomitant maternal risk factors.

2.3. Prenatal ultrasonography examination

The prenatal ultrasonography assessment was performed using the ARIETTA 850 (Hitachi Healthcare, C1-5 convex array probes, 1–5 MHz, Japan) and included fetal weight estimation, polyhydramnios-related amniotic fluid measurements and the detailed assessment of the fetal anatomy in cases with suspected fetal pathology.

2.4. Statistical analysis

Descriptive statistics were reported including frequencies and percentages for categorical variables.

3. Results

3.1. Maternal and obstetric characteristics and polyhydramnios etiology

Mean maternal age was 32 years (range, 22 to 47 years). Overall, 50% of women were multiparous and 32.4% were grand-multiparous (Table 1).

Table 1. Maternal and obstetric characteristics and polyhydramnios etiology

Maternal age (year), mean (min-max)	32 (22-47)
Parity, n (%)	
Nulliparous	58 (17.6)
Multiparous	165 (50.0)
Grand-multiparous	107 (32.4)
Polyhydramnios etiology, n (%)	
Idiopathic	155 (47.0)
Maternal diabetes	97 (29.4)
- Type 1 diabetes	15 (4.5)
- Type 2 diabetes	19 (5.8)
- Gestational diabetes on insulin	26 (7.9)
- Gestational diabetes on diet	37 (11.2)
Fetal conditions	78 (23.6)

The polyhydramnios was idiopathic in 47.0% of cases, while the maternal diabetes (29.4%) and fetal conditions (23.6%) were responsible for the etiology in the remaining cases of polyhydramnios (Table 1).

3.2. Prenatal ultrasonography findings on fetal conditions (n=78)

The most common anomalies identified on prenatal ultrasonography were central nervous system (CNS) anomalies (29.5%), followed by the gastrointestinal system anomalies (11.5%) (Table 2).

Table 2. Detailed prenatal ultrasonography findings for fetal conditions related to polyhydramnios (n=78)

	Fetal conditions (n=78)
Prenatal ultrasonography findings, n (%)	
Central nervous system anomalies	23 (29.5)
- Anencephaly	4 (5.1)
- Hydrocephaly	4 (5.1)
- Spina bifida	10 (12.8)
- Encephalocele	3 (3.9)
- Corpus callosum agenesis	2 (2.6)
Gastrointestinal system anomalies	9 (11.5)
- Esophageal atresia	5 (6.4)
- Duodenal atresia	3 (3.9)
- Imperforate anus	1 (1.3)
Genitourinary anomaly	7 (9.0)
Skeletal dysplasia	6 (7.7)
Non-immune hydrops fetalis	5 (6.4)
Diaphragmatic hernia	5 (6.4)
Cardiac anomalies	5 (6.4)
Pulmonary system anomalies	5 (6.4)
- Congenital pulmonary airway malformation	3 (3.9)
- Bronchopulmonary sequestration	2 (2.6)
Chromosomal anomaly	5 (6.4)
- Trisomy 18	4 (5.1)
- Trisomy 21	1 (1.3)
Fetal akinesia syndrome	3 (3.9)
Immune hydrops fetalis	2 (2.6)
Cystic hygroma	2 (2.6)
Facial defect (cleft lip-palate)	1 (1.3)

3.3. Cesarean delivery rate and adverse pregnancy outcomes

Cesarean delivery occurred in 126 (38.2%) of 330 pregnancies with polyhydramnios, due to previous cesarean history in most cases (42.9%), followed by fetal distress (19.8%), labor dystocia (14.3%) and suspected fetal macrosomia (11.9%) (Table 3).

Adverse pregnancy outcomes were noted in 213 (64.5%) of 330 pregnancies with polyhydramnios, and included delivery of a neonate with congenital anomaly (36.6%), macrosomia (21.1%), preterm delivery (18.3%), perinatal mortality (13.1%) and pregnancy termination (10.8%) (Table 3).

Table 3. Cesarean section delivery and adverse pregnancy outcomes (n=330)

Cesarean delivery, n (%)	126 (38.2)
Cesarean indications, n (%)	
- Previous cesarean history	54 (42.9)
- Fetal distress	25 (19.8)
- Labor dystocia	18 (14.3)
- Suspected fetal macrosomia	15 (11.9)
- Fetal malpresentation	8 (6.3)
- Placenta previa	4 (3.2)
- Umbilical cord prolapse	2 (1.6)
Adverse pregnancy outcome, n (%)	213 (64.5)
- Delivery of a neonate with congenital anomaly	78 (36.6)
- Macrosomia (>4000 g birthweight)	45 (21.1)
- Preterm delivery (<37th gestational week)	39 (18.3)
- Perinatal mortality	28 (13.1)
- Pregnancy termination due to concomitant multiple fetal anomaly	23 (10.8)

4. Discussion

Our findings revealed that almost half of pregnancies with polyhydramnios were idiopathic, while maternal diabetes and fetal anomalies (CNS and gastrointestinal anomalies) were responsible for ~30% and 20% of cases, respectively. Overall, 38.2% of women had cesarean delivery, while adverse pregnancy outcome was noted in 64.5% of cases, including congenital anomaly (36.6%), macrosomia (21.1%), preterm delivery (18.3%), perinatal mortality (13.1%) and pregnancy termination (10.8%).

Our findings support the predominance of idiopathic polyhydramnios with no evidence for maternal or fetal pathology in pregnancies with polyhydramnios (1, 8, 10-12), whereas indicate a lower rate of idiopathic polyhydramnios (~50% vs. ~70%) and higher rates of polyhydramnios due to maternal diabetes (~30% vs. ~20-25%) and fetal pathology (~20% vs. ≤11%) compared to most of the previous studies (1,4,10-13).

Nonetheless, there also some studies reporting similarly high rates of fetal anomaly (~30%) regardless of the degree of AFI excess, suggesting the consideration of the likelihood of fetal anomaly in all cases of polyhydramnios, even in those with only mildly elevated amniotic fluid volumes (1, 8, 14).

Especially, almost 10% of cases with idiopathic polyhydramnios were reported to be accompanied by a fetal anomaly (mainly the gastrointestinal atresia) that was only found after birth, while none of the antenatal characteristics (i.e., amniotic fluid volume, estimated fetal weight or gestational and maternal age at the time of diagnosis) was found helpful in detecting these anomalies before birth (13, 14). Also, in a study on the outcomes of children from pregnancies complicated with polyhydramnios without fetal anomalies, the authors emphasized the likelihood of polyhydramnios to be associated with increased rate of fetal malformations, genetic syndromes, neurologic disorders, and developmental delay, which may be diagnosed only after birth (15). Moreover, use of 75 g OGTT with the fixed cut offs is considered not appropriate to identify gestational diabetes in some cases, and gestational diabetes with increased birthweight is considered likely even with blood glucose levels were below the cut-offs (14, 16).

Hence, our findings emphasize the likelihood of a certain proportion of cases with apparently idiopathic polyhydramnios to actually be related to gestational diabetes or fetal anomaly (14), which seems to emphasize the contributory role of differences in accurate prenatal diagnosis rates in the discordance noted between studies on polyhydramnios etiology.

Our findings support the consideration of gastrointestinal tract anomalies, CNS anomalies, musculoskeletal anomalies, airway malformation and congenital diaphragmatic hernia amongst the most common fetal congenital anomalies associated with polyhydramnios (1, 11, 14, 17, 18). In contrast to other studies reporting the cardiac anomalies as the most frequently diagnosed anomaly in fetuses of mother with polyhydramnios (5, 19, 20). Our findings revealed a lower rate of cardiac anomalies and no cases of congenital infection as a cause of polyhydramnios. Likewise, some polyhydramnios studies did not find any case of cardiac malformation (11), and also indicated a rare frequency of congenital infection as a cause of polyhydramnios (11, 12).

The type of CNS anomalies diagnosed on ultrasonography in the current study including spina bifida in 12.8% of cases, followed by anencephaly and hydrocephaly (each in 5.1%) is in agreement with consideration of polyhydramnios as a risk factor for neural tube defects such as spina bifida, anencephaly and encephalocele (21, 22).

In the current study, maternal diabetes was responsible for ~30% of polyhydramnios cases, and the gestational diabetes rather than pre-gestational diabetes was the responsible factor (19.1% vs. 10.3%) along with presence of fetal macrosomia in 21.1% of deliveries. Especially ~25% of all pregnancies with polyhydramnios are considered to be due to gestational diabetes, and about 8-20% of all pregnancies with gestational diabetes are complicated by polyhydramnios (13, 14). Hence, our findings seem to emphasize the role of obligatory OGTT between 24 and 28 weeks of gestation, as well as the monitoring the glycemic status via HbA1c and blood glucose testing after 28 weeks of gestational age. Nonetheless, a tendency for macrosomic fetuses and increased likelihood of adverse pregnancy outcomes has also been noted in pregnancies with gestational diabetes and polyhydramnios vs. those without polyhydramnios, even with strict metabolic control after diagnosis (5, 14, 23, 24). Indeed, a 11-fold increased risk for macrosomia was reported with polyhydramnios but only in the concomitant presence of accelerated fetal growth (AFG) (9). The pregnancies with normal OGTT that develop polyhydramnios and AFG are considered to be at higher risk for maternal and neonatal complications, while isolated polyhydramnios without AFG is considered to increase the risk for delivery complications but

not the neonatal morbidity (9).

Our findings are consistent with previous reports indicated that fetal structural anomalies can be found in 8-45 % of pregnancies with polyhydramnios, whereas the fetal aneuploidies, including trisomy 13, 18, and 21 are observed in only 0.4-10% (4, 5, 10, 11, 20, 23-27). Given that chromosomal anomaly was evident in 6.4% of our cases, which is close to upper limit of the reported range, our findings may emphasize the utility of routine karyotyping in ultrasonographically isolated polyhydramnios (28). In fact, in a meta-analysis of 20 studies in 1729 pregnancies with idiopathic polyhydramnios on the risk of chromosomal aberrations, the authors reported the rate of chromosomal aberrations to range between 0 and 13.8% along with a relative risk of 3.1 for chromosomal aberration in women at high risk for aneuploidy (29). However, given the lack of studies on the relative risk for chromosomal abnormalities in low-risk women with idiopathic polyhydramnios, the authors concluded that the suboptimal quality of the evidence precludes from drawing any solid conclusions on routine karyotype testing in idiopathic polyhydramnios cases, especially in women at low risk for chromosomal aberrations (29).

Regarding the mode of delivery, cesarean delivery was noted in 38.2% of pregnancies in our study (due to fetal distress in 19.8% and fetal macrosomia in 11.9%), supporting previously reported high rates of elective cesarean sections in polyhydramnios cases due to fetal anomaly (22.9 %) and maternal diabetes (21.2 %) (10). In addition, in a retrospective matched case control study with 588 singleton pregnancies, the rate of cesarean delivery was reported to be significantly higher among women with vs. without polyhydramnios (31.3% vs. 18.7%) (30), while the multivariate logistic regression analyses also revealed polyhydramnios to be an independent risk factor for delivery by a caesarean (OR, 2.0 to 21.02) (30, 31). Also, in a study on the outcomes of children from pregnancies complicated with polyhydramnios but a normal detailed ultrasound examination during pregnancy, polyhydramnios was reported to be associated with increase in the risk of elective cesarean delivery due to suspected macrosomia (15).

Preterm delivery (18.3%), delivery with a congenital anomaly (36.6%), perinatal mortality (13.1%) and pregnancy termination (10.8%) rates in the present study, supports the consideration of fetuses with polyhydramnios and congenital anomalies to have a higher risk of perinatal complications with particular increase in the risk of preterm delivery (10, 14, 32). In addition, the ongoing risk of intrauterine fetal demise was also reported to in pregnancies affected by polyhydramnios at every gestational age (7-fold by 37 weeks, and 11-fold by 40 weeks) compared with unaffected pregnancies (33). Likewise, in a study with 50 pregnant women with polyhydramnios vs. 80 pregnant women with normal amniotic fluid, the authors also noted significantly higher occurrences of fetal anomaly, cesarean section, preterm birth, fetal distress and fetal macrosomia in patients with vs. without polyhydramnios (34). Hence, our findings support the crucial role of monitoring of the maternal-fetal condition in pregnancies with polyhydramnios given the association of prenatal diagnosis of polyhydramnios with a higher occurrence of adverse perinatal outcomes (14, 33, 34).

Certain limitations to this study should be considered. First, potential lack of generalizability is an important limitation due to single-center study design with relatively small sample size. Second, lack of data on severity and gestational age at the time of polyhydramnios diagnosis is another limitation which otherwise would extend the knowledge achieved.

In conclusion, our findings revealed the polyhydramnios to be idiopathic in half of cases, and to be due to either maternal diabetes or fetal pathology in the other half. Given the occurrence of adverse pregnancy outcomes in a considerable portion of pregnancies with polyhydramnios, our findings emphasize the vital role of intensive monitoring of the maternal-fetal condition in pregnancies with polyhydramnios. Meticulous diagnostic approach seems crucial for timely recognition of fetal anomalies via detailed imaging studies, given the likelihood of erroneously diagnosed idiopathic polyhydramnios to challenge the implementation of proper management and appropriate counselling of patients.

Conflict of interest

The authors declare that they have no conflict of interest.

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Authors' contributions

Concept: Ö.Ö., G.B., U.Ç., Design: Ö.Ö., G.B., U.Ç., Data Collection or Processing: Ö.Ö., G.B., K.B., Analysis or Interpretation: Ö.Ö., U.Ç., Literature Search: Ö.Ö., U.Ç., Writing: Ö.Ö., G.B., U.Ç.

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