

# Idiopathic Polyhydramnios and Postnatal Abnormalities

Harald Abele Sandra Starz Markus Hoopmann Britta Yazdi Katharina Rall  
Karl Oliver Kagan

Department of Obstetrics and Gynaecology, University of Tübingen, Tübingen, Germany

## Key Words

Amniotic fluid · Amniotic fluid index · Major anomalies · Idiopathic polyhydramnios

## Abstract

**Objective:** To investigate the proportion and type of fetal anomalies that are associated with polyhydramnios and to examine whether in cases with idiopathic polyhydramnios during the course of pregnancy and fetal anomalies only diagnosed after birth, antenatal characteristics differ. **Methods:** This was a retrospective study involving all pregnancies with polyhydramnios defined by a deepest pool of amniotic fluid  $\geq 8$  cm and a detailed ultrasound examination, a 75 g glucose tolerance test and a TORCH serology. **Results:** Between 2004 and 2010, 272 pregnancies fulfilled the inclusion criteria. In 89 (32.7%) and 65 (23.9%) cases, there was a fetal anomaly or diabetes. In 118 (43.4%) pregnancies, polyhydramnios was classified as idiopathic. In 11 (9.3%) of the 118 fetuses, an anomaly was found after birth, mainly gastrointestinal atresia. In these cases, median deepest pool of amniotic fluid was 9.6 cm, and median estimated fetal weight was at the 69th centile, whereas in cases without anomalies diagnosed after birth, median deepest pool was 9.0 cm and median estimated fetal weight at the 90th centile (Mann-Whitney U test: deepest pool  $p = 0.116$ , and estimated fetal

weight centile  $p = 0.377$ ). There was also no difference in the maternal and gestational age distribution of these cases (Mann-Whitney U test: maternal age  $p = 0.293$ , and gestational age  $p = 0.499$ ). **Conclusion:** In about 40% of pregnancies, polyhydramnios remains unexplained during the course of pregnancy. In 10% of these cases, an anomaly will only be found after birth. In this group, antenatal characteristics such as amniotic fluid volume, estimated fetal weight or gestational and maternal age at the time of diagnosis do not help to detect these anomalies before birth.

Copyright © 2012 S. Karger AG, Basel

## Introduction

Polyhydramnios can be found in about 1–2% of all pregnancies. It is generally defined as amniotic fluid volume of 2,000 ml or more [1]. There is a well-known association with fetal anomalies, fetal anemia and maternal diabetes. About a third of these cases are associated with structural defects, especially with gastrointestinal atresia and central nervous system (CNS) anomalies and in about a fourth of the cases, maternal diabetes can be found [2].

Dashe et al. [3] demonstrated that among 672 pregnancies with polyhydramnios, the prevalence of fetal

anomalies increased with increasing amniotic fluid volume from 1% in cases with mild polyhydramnios to 11% in cases with severe polyhydramnios, respectively. In 28, 22, 14 and 11% of these cases, fetal defects involved the CNS, the fetal heart, the gastrointestinal system and the thorax, respectively. The amount of amniotic fluid was not predictive of the type of anomaly. However, it was shown that the extent of polyhydramnios in pregnancies with fetal anomalies correlates with the risk of preterm delivery complicating these cases [4].

About a fourth of all pregnancies with polyhydramnios are due to gestational diabetes, and about 8–20% of all pregnancies with gestational diabetes are complicated by polyhydramnios [3]. Even with strict metabolic control after diagnosis, fetuses tend to be larger in pregnancies with gestational diabetes and polyhydramnios compared to those without polyhydramnios [5]. As a consequence, adverse pregnancy outcome may be more frequent in this group [6, 7].

About half of the cases with polyhydramnios remain unexplained or idiopathic during the course of the pregnancy [3]. In some of these cases, a fetal abnormality will only be diagnosed after birth. Other cases will remain unclear with uneventful pregnancy outcome.

In this study, we examined firstly the proportion and type of fetal anomalies that are associated with polyhydramnios, and secondly whether in cases with idiopathic polyhydramnios during the course of pregnancy and fetal anomalies only diagnosed after birth antenatal characteristics differ.

## Methods

A search of the electronic perinatal database at the Department of Obstetrics and Gynaecology, University of Tübingen, was performed to identify all prenatal singleton cases with polyhydramnios with a single deepest pool of amniotic fluid (SDP) of 8 cm or more after 24 weeks [8].

In all cases, medical records were reviewed to collect data on maternal age, gestational age at the time of diagnosis of polyhydramnios, preexisting diabetes mellitus or gestational diabetes, results of the 75 g oral glucose tolerance test (oGTT), results of the TORCH serology, including Parvo B19 serology, and results of the ultrasound examination.

The ultrasound examination included a fetal weight estimation based on the Hadlock formula, a measurement of the deepest pool of amniotic fluid, fetal Doppler studies of the middle cerebral artery and of the umbilical artery in growth-restricted fetuses and a detailed assessment of the fetal anatomy [9]. For this study, only major fetal anomalies were considered as relevant and were recorded in the study database, minor markers such as single umbilical artery or other soft markers were not taken into account.

Concerning the oGTT, a 75 g oGTT was done by local gynecologists, who measured the blood sugar level by capillary blood samples according to the guidelines that were valid at the time of diagnosis. For this study, the local gynecologists were contacted to obtain the results of the fasting blood sugar level and the results immediately before and 1 and 2 h after drinking the glucose solution. In some cases, only the presence of gestational diabetes but not the individual results of the three blood tests were available. These cases were classified accordingly.

The outcome of all cases was obtained by contacting the gynecologists, the pediatricians and the parents. Data were collected on fetal birthweight and the respective centile, Apgar, postpartum pH, karyotype and fetal anomalies if present.

The cases were stratified according to the origin of the polyhydramnios into fetal anomalies, gestational diabetes and diabetes mellitus, infection and unclear polyhydramnios. There was only one pregnancy that was complicated by an infection. As in this case, there was also diabetes mellitus, the diabetes and infection groups were pooled.

### Statistical Methods

The statistical analysis was performed with SPSS 19 (IBM SPSS statistics, Armonk, N.Y., USA). Differences were tested with Kruskal-Wallis and Mann-Whitney U tests due to their non-normal distribution. A p value of  $\leq 0.05$  was considered statistically significant.

## Results

Between 2004 and 2010, 272 pregnancies fulfilled the inclusion criteria. Median maternal age was 33.3 (IQR 29.2–37.2) years and median gestational age when polyhydramnios was diagnosed was 35.0 (IQR 30.7–37.1) weeks of gestation. At this time, median deepest pool of amniotic fluid was 9.0 (IQR 8.3–10.2) cm. Median estimated fetal weight was 2,442 (IQR 1,746–3,344) g, which corresponds to the 85th centile. Due to severe maternal discomfort, amnion drainage was performed at least once in 28 (10.3%) cases, and it was done more than once in 10 (3.7%) of the 272 cases.

In 89 (32.7%) cases, detailed ultrasound examination revealed a fetal anomaly. Gestational diabetes or diabetes mellitus was noticed in 65 (23.9%) cases, and in only one case was there a Parvo B19 infection. In this case, peak velocity of the mid-cerebral artery was increased to more than 1.5 MoM. For further analysis, these two latter groups were pooled together due to the preexisting diabetes mellitus in this case. In 118 (43.4%) pregnancies, polyhydramnios was classified as idiopathic.

Table 1 shows the maternal and gestational age distribution, the amniotic fluid volume and the estimated fetal weight in the anomaly, diabetes and idiopathic group. While the idiopathic and diabetes groups seem similar,

**Table 1.** Maternal and gestational age distribution, estimated fetal weight and amniotic fluid volume in cases with a suspected fetal anomaly, diabetes/infection and in pregnancies with unclear polyhydramnios

Maternal and pregnancy characteristics	Fetal anomaly (n = 89)	Diabetes (n = 65)	Idiopathic (n = 118)	Total (n = 272)
Maternal age, years	31.6 (27.2–36.3)	34.9 (31.5–38.9)	33.4 (29.7–36.8)	33.3 (29.2–37.2)
Gestational age, weeks	33.7 (31.3–37.0)	35.6 (32.3–37.6)	36.1 (31.4–38.7)	35.0 (31.4–37.7)
Fetal weight estimation, g	2,005 (1,479–2,617)	2,717 (2,032–3,373)	2,935 (1,970–3,519)	2,442 (1,737–3,345)
Fetal weight centile, %	61.8 (7.5–92.0)	91.1 (58.1–97.7)	88.7 (54.1–96.9)	85.4 (37.6–97.0)
Amniotic fluid volume deepest pool, cm	9.3 (8.3–11.0)	8.7 (8.0–10.0)	9.0 (8.4–10.0)	9.0 (8.3–10.2)

Values are expressed as median (IQR).

Kruskal-Wallis test: maternal age:  $p = 0.007$ ; Mann-Whitney-U-Test: anomaly vs. diabetes group  $p = 0.004$ ; anomaly vs. unclear group  $p = 0.060$ ; diabetes vs. unclear group  $p = 0.060$ .

Kruskal-Wallis Test: gestational age  $p = 0.019$ ; Mann-Whitney-U-Test: anomaly vs. diabetes group  $p = 0.072$ ; anomaly vs. unclear group  $p = 0.008$ ; diabetes vs. unclear group  $p = 0.331$ .

Kruskal-Wallis test: estimated fetal weight centile  $p < 0.0001$ ; Mann-Whitney-U-Test: anomaly vs. diabetes group  $p = 0.001$ ; anomaly vs. unclear group  $p < 0.0001$ ; diabetes vs. unclear group  $p = 0.470$ .

Kruskal-Wallis test: deepest pool  $p = 0.017$ ; Mann-Whitney-U-Test: anomaly vs. diabetes group  $p = 0.006$ ; anomaly vs. unclear group  $p = 0.169$ ; diabetes vs. unclear group  $p = 0.060$ .

there are significant differences between the anomaly group and the other two groups. The proportion of cases of fetal anomalies correlated positively with the amount of amniotic fluid ( $p = 0.002$ ,  $r = 0.999$ ) and negatively with the estimated fetal weight centile ( $p = 0.026$ ,  $r = 0.921$ ). In contrast, there was no correlation between the proportion of diabetes or idiopathic cases and amniotic fluid (diabetes:  $p = 0.378$ ,  $r = 0.829$ ; idiopathic:  $p = 0.557$ ,  $r = 0.630$ ) or fetal weight centiles (diabetes:  $p = 0.441$ ,  $r = 0.445$ ; idiopathic:  $p = 0.230$ ,  $r = 0.655$ ).

The suspected anomalies that were found prenatally are demonstrated in table 2. In 29 (32.6%) of the 89 cases, there was a gastrointestinal obstruction. In 24 (27.0%) cases, multiple defects were found; seven of those were caused by numerical chromosomal abnormalities.

In the group of idiopathic polyhydramnios, the postnatal examination revealed a prenatally unexpected anomaly in 11 (9.3%) of the 118 fetuses. In 4 cases, there was a gastrointestinal atresia, one fetus was also affected by trisomy 21. The other cases were affected by Noonan syndrome ( $n = 1$ ), an intrahepatic atrioventricular shunt ( $n = 1$ ), unclear encephalopathy ( $n = 1$ ), Pierre-Robin sequence with cleft palate ( $n = 1$ ) and hypospadias ( $n = 3$ ). In these cases, median deepest pool of amniotic fluid was 9.6 cm, and median estimated fetal weight was at the 69th centile, whereas in cases without anomalies diagnosed after birth, median deepest pool was 9.0 cm and median estimated fetal weight at the 90th centile (Mann-Whit-

**Table 2.** Major fetal anomalies associated with polyhydramnios that were diagnosed antenatally

Major fetal anomalies	n	%
Gastrointestinal obstruction	29	32.6
Renal abnormalities	9	10.1
Nonimmune and noninfectious hydrops	8	9.0
Central nervous abnormalities	7	7.9
Fetal tumor with AV malformation	5	5.6
Diaphragmatic hernia	3	3.4
Fetal akinesia and skeletal dysplasia	2	2.2
Cardiac defects and arrhythmia	2	2.2
Multiple abnormalities <sup>1</sup>	24	27.0
Total fetuses	89	100.0

<sup>1</sup> In these 24 cases, there were 15 gastrointestinal atresias, 12 cardiac defects, 7 CNS abnormalities, 9 renal defects, 2 fetuses with hydrops and 8 other major abnormalities. Thirteen fetuses had chromosomal abnormalities or genetic syndromes.

ney-U-Test: deepest pool  $p = 0.116$ , and estimated fetal weight centile  $p = 0.377$ ). There was also no difference in the maternal and gestational age distribution of these cases (Mann-Whitney-U-Test: maternal age  $p = 0.293$ , and gestational age  $p = 0.499$ ).

In 63 (58.9%) of 107 cases of idiopathic polyhydramnios without postnatally diagnosed anomalies, the full

test result of the 75 g oGTT was available. Median test results (fasting, 1 and 2 h after glucose intake) were 75 (IQR 70.0–80.3), 128 (111.5–140.0) and 104 (91–117) mg/dl, respectively. The respective figures in the group of postnatally detected anomalies were 76 (74–78), 119 (111–129) and 103 (100–111) mg/dl, respectively.

Among the 28 pregnancies that were treated with amnion drainages, there were 21 (75%) cases with prenatally detected anomalies and 3 (10.7%) cases with diabetes, respectively. There were 4 (14.3%) pregnancies that were antenatally classified in the group of idiopathic polyhydramnios, in 2 of those, an anomaly was found postnatally.

## Discussion

In summary, in about a third of pregnancies with polyhydramnios, a fetal anomaly was found antenatally; in about a fourth of the cases, polyhydramnios was caused by diabetes, and in about 40% of the cases polyhydramnios was idiopathic. In the latter group, about 10% of the cases were complicated by an anomaly that was only found after birth.

Fetuses with anomalies were smaller and had more pronounced polyhydramnios. However, in the idiopathic group, neither the amniotic fluid volume nor the fetal weight estimation or the other examined parameters were helpful to antenatally identify pregnancies that were at risk of being complicated by anomalies only diagnosed after birth. These were predominantly fetuses with esophageal atresia. The other cases involved genetic syndromes and anomalies with known relation to polyhydramnios. The 3 cases with hypospadias and polyhydramnios are more difficult to explain. Most probably, these findings were coincidental or perhaps related to a genetic syndrome that was not diagnosed yet.

There are still controversies whether it is better to use the SDP method or to use the amniotic fluid index (AFI) to detect an abnormal amount of amniotic fluid (10, 11). In a study of 291 pregnancies, Magann et al. [11] measured the amniotic fluid volume by a dye dilution technique during third trimester amniocentesis and compared the results with their sonographic estimation. They found that by using the SDP technique with cut offs of 2 and 8 cm and the AFI technique with cut offs of 5 and 18 cm, 64 and 61% of the pregnancies were classified appropriately. The SPD technique was less dependent on the fetal position and better in identifying a normal amniotic fluid volume between the 5th and 95th centile (95 vs.

85% detection rate). The AFI technique was advantageous in identifying cases with amniotic fluid volume above the 95th centile (39 vs. 23%) [11]. In a more recent literature review, the same work group concluded that none of the methods is superior to the other, but with the AFI method polyhydramnios is significantly more often diagnosed without any improvement in the outcome [12].

In view of the observed fetal abnormalities, our results are consistent with previous studies. In a very recent study, Pri-Paz et al. [7] examined the outcome of 524 pregnancies complicated by polyhydramnios. Similar to our study, they observed that in about a fourth of the cases, there was diabetes, and in about a third of the cases a fetal abnormality was found. The proportion of fetuses with abnormalities increased with amniotic fluid volume. Dashe et al. reported that among 672 pregnancies with polyhydramnios, there were 11% of fetuses with abnormalities. They also observed an increasing prevalence of abnormalities with increasing amniotic fluid volume. The most common fetal defects concerned the CNS, the heart and the gastrointestinal system. The spectrum of prenatally missed anomalies that were only diagnosed after birth was similar to the one presented in this study including fetal CNS, facial, gastrointestinal and cardiac defects [3].

Ben-Chetrit et al. [13] also studied the spectrum of abnormalities associated with polyhydramnios. In their study, gastrointestinal malformations (39%) were most frequent, followed by abnormalities of the CNS (26%), circulatory (22%), and urinary tract (13%) anomalies.

Ozawa et al. [14] examined whether in fetuses with exomphalos, polyhydramnios is an additional predictor for adverse outcome. In their study, polyhydramnios was found in about a third of the cases, and all pregnancies were complicated by additional anomalies.

The association between CNS defects, gastrointestinal obstruction, cardiac defects, thoracic anomalies, aneuploidy and hydrops is well established, and the pathophysiology is acceptably clear. Surprisingly, about 10% of the isolated abnormalities involved renal defects. Predominantly, these were cases with severe renal outflow obstruction and unilateral cystic kidney diseases. However, in older studies, published in the late 1980s, the same association was noticed before [15, 16]. An impairment of the renal concentrating ability may be responsible for the increased amniotic fluid volume in these cases.

Interestingly, there was only one case with an abnormal TORCH serology. In this case of a Parvo B19 infection, anemia was already anticipated due to the infection of the first child and due to the increased peak velocity in

the mid-cerebral artery. This is in concordance with other studies questioning the usefulness of TORCH serology in cases with polyhydramnios [17, 18].

A weakness of our retrospective study is that we had to use the old criteria for the diagnosis of gestational diabetes although they have been recently updated. This was due to the fact that in the majority of the cases, the blood sugar levels were measured in capillary blood instead of venous plasma. In addition, in some cases only the diagnosis of gestational diabetes at the time of pregnancy was available but not the actual measurements. Following the recommendation of the International Association of the Diabetes and Pregnancy Study Groups, blood sugar levels should only be measured in venous plasma with cut offs of 92 (5.1), 180 (10.0) and 153 mg/dl (8.5 mmol/l) in the future to reach a high level of standardization and reduce measurement errors [19].

In our study, the group of idiopathic polyhydramnios and diabetes were similar in view of the extent of the

polyhydramnios, the estimated fetal weight and the gestational age when polyhydramnios was first noticed. This could lead to the assumption that a certain proportion of cases with apparently idiopathic polyhydramnios were in reality related to gestational diabetes, and the 75 g oGTT with the fixed cut offs was not appropriate to identify gestational diabetes in these cases. This is concordance with the discovery of the HAPO Study of a fluent passage indicating that even with blood sugar levels under the given cut offs there can be gestational diabetes with increased birthweight [20].

In summary, in about 40% of pregnancies polyhydramnios remains unexplained during the course of pregnancy. In 10% of these cases an anomaly will only be found after birth. In this group, antenatal characteristics such as amniotic fluid volume, estimated fetal weight or gestational and maternal age at the time of diagnosis do not help to detect these anomalies before birth.

## References

- 1 Queenan JT, Thompson W, Whitfield CR, Shah SI: Amniotic fluid volumes in normal pregnancies. *Am J Obstet Gynecol* 1972;114: 34–38.
- 2 Magann EF, Chauhan SP, Doherty DA, Lutgendorf MA, Magann MI, Morrison JC: A review of idiopathic hydramnios and pregnancy outcomes. *Obstet Gynecol Surv* 2007; 62:795–802.
- 3 Dashe JS, McIntire DD, Ramus RM, Santos-Ramos R, Twickler DM: Hydramnios: anomaly prevalence and sonographic detection. *Obstet Gynecol* 2002;100:134–139.
- 4 Many A, Lazebnik N, Hill LM: The underlying cause of polyhydramnios determines prematurity. *Prenat Diagn* 1996;16:55–57.
- 5 Shoham I, Wiznitzer A, Silberstein T, Fraser D, Holberg G, Katz M, et al: Gestational diabetes complicated by hydramnios was not associated with increased risk of perinatal morbidity and mortality. *Eur J Obstet Gynecol Reprod Biol* 2001;100:46–49.
- 6 Desmedt EJ, Henry OA, Beischer NA: Polyhydramnios and associated maternal and fetal complications in singleton pregnancies. *Br J Obstet Gynaecol* 1990;97:1115–1122.
- 7 Pri-Paz S, Khalek N, Fuchs KM, Simpson LL: Maximal amniotic fluid index as a prognostic factor in pregnancies complicated by polyhydramnios. *Ultrasound Obstet Gynecol* 2011, Epub ahead of print.
- 8 Magann EF, Sanderson M, Martin JN, Chauhan S: The amniotic fluid index, single deepest pocket, and two-diameter pocket in normal human pregnancy. *Am J Obstet Gynecol* 2000;182:1581–1588.
- 9 Hadlock FP, Harrist RB, Carpenter RJ, Deter RL, Park SK: Sonographic estimation of fetal weight. The value of femur length in addition to head and abdomen measurements. *Radiology* 1984;150:535–540.
- 10 Fok WY, Chan LY, Lau TK: The influence of fetal position on amniotic fluid index and single deepest pocket. *Ultrasound Obstet Gynecol* 2006;28:162–165.
- 11 Magann EF, Doherty DA, Chauhan SP, Busch FWJ, Mecacci F, Morrison JC: How well do the amniotic fluid index and single deepest pocket indices (below the 3rd and 5th and above the 95th and 97th percentiles) predict oligohydramnios and hydramnios? *Am J Obstet Gynecol* 2004;190:164–169.
- 12 Magann EF, Chauhan SP, Doherty DA, Magann MI, Morrison JC: The evidence for abandoning the amniotic fluid index in favor of the single deepest pocket. *Am J Perinatol* 2007;24:549–555.
- 13 Ben-Chetrit A, Hochner-Celnikier D, Ron M, Yagel S: Hydramnios in the third trimester of pregnancy: a change in the distribution of accompanying fetal anomalies as a result of early ultrasonographic prenatal diagnosis. *Am J Obstet Gynecol* 1990;162: 1344–1345.
- 14 Ozawa K, Ishikawa H, Maruyama Y, Nagata, T, Nagase H, Itani Y, Kurosawa K, Yamanaka M: Congenital omphalocele and polyhydramnios: a study of 52 cases. *Fetal Diagn Ther* 2011;30:184–188.
- 15 Kleiner B, Callen PW, Filly RA: Sonographic analysis of the fetus with ureteropelvic junction obstruction. *AJR Am J Roentgenol* 1987; 148:359–363.
- 16 Barkin SZ, Pretorius DH, Beckett MK, Manchester DK, Nelson TR, Manco-Johnson ML: Severe polyhydramnios: incidence of anomalies. *AJR Am J Roentgenol* 1987;148:155–159.
- 17 Abdel-Fattah SA, Bhat A, Illanes S, Bartha JL, Carrington D: TORCH test for fetal medicine indications: only CMV is necessary in the United Kingdom. *Prenat Diagn* 2005;25: 1028–1031.
- 18 Fayyaz H, Rafi J: TORCH screening in polyhydramnios: an observational study. *J Matern Fetal Neonatal Med* 2011, Epub ahead of print.
- 19 Deutsche Diabetes Gesellschaft: Evidenzbasierte Leitlinie zu Diagnostik, Therapie und Nachsorge. [http://www.deutsche-diabetesgesellschaft.de/redaktion/news/EbLL\\_GDM\\_ENDFASSUNG\\_2011\\_01\\_28\\_E1.pdf](http://www.deutsche-diabetesgesellschaft.de/redaktion/news/EbLL_GDM_ENDFASSUNG_2011_01_28_E1.pdf), accessed on January 15, 2012.
- 20 HAPO Study Cooperative Research Group, Metzger BE, Lowe LP, Dyer AR, Trimble ER, Chaovarindr U, et al: Hyperglycemia and adverse pregnancy outcomes. *N Engl J Med* 2008;358:1991–2002.