

Perinatal Outcomes of Polyhydramnios without Associated Congenital Fetal Anomalies after the Gestational Age of 20 weeks

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Background: Polyhydramnios carries a high rate of complications during pregnancy and adverse perinatal outcomes. We could find no studies of this condition in a large Asian population. The aim of this investigation was to evaluate the risks of adverse perinatal outcomes in a large study population with polyhydramnios without associated fetal anomalies after the gestational age of 20 weeks in Taiwan.

Methods: We retrospectively reviewed the computerized records of women who had babies without associated fetal anomalies after the gestational age of 20 weeks at Chang Gung Memorial Hospital from July 1990 to December 2001. Possible confounding factors that could affect the occurrence of polyhydramnios were analyzed. We then investigated the relative risks of these events to adverse perinatal outcome by adjusting the variants.

Results: Significantly higher incidences of preeclampsia, placental abruption, placenta accreta, past history of fetal death or preterm delivery, multiple pregnancy, bodyweight gain ≥ 20 kg during pregnancy and primiparity were noted in patients with polyhydramnios than in patients without this condition. The presence of polyhydramnios significantly increased the rate of preterm delivery, low birth weight or very low birth weight, low one- and five-minute Apgar scores, fetal death, large for gestational age babies, meconium-stained amniotic fluid, Cesarean section, fetal distress in labor, NICU transfer and neonatal death.

Conclusions: Polyhydramnios carried a higher incidence of adverse perinatal outcomes, such as low Apgar scores, fetal death, fetal distress in labor, NICU transfer and neonatal death, despite exclusion of congenital anomalies from the study population. Detailed antepartum fetal well-being surveillance, intensive intrapartum monitoring and further attention postpartum are warranted in patients with this condition.

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Polyhydramnios, defined as an amniotic fluid index (AFI) greater than 24 cm on linear-array real-time obstetric ultrasound, occurs in 0.4% to 3.3% of all pregnancies.⁽¹⁾ A higher rate of complications during pregnancy has been associated with polyhydramnios assessed either by the single largest pocket measurement or using a semi-quantitative manner.^(1,2) Perinatal morbidity and mortality rates also significantly increase.⁽³⁻⁵⁾

There are various etiologic factors of polyhydramnios and this condition may complicate many maternal and fetal problems.⁽⁶⁻⁸⁾ Congenital fetal anomalies constitute one of the important etiologic factors associated with polyhydramnios and have an influence on the management and prevalence of adverse pregnancy outcomes.^(7,8) We could find no reports in the literature assessing the relative risk of adverse perinatal outcomes of polyhydramnios without associated congenital fetal anomalies and no reports about a cohort of Asian women with a sizable watched control group by adjusting possible confounding factors. Therefore the major purpose of this investigation was to evaluate the risks of adverse perinatal outcomes in a large study population with polyhydramnios but without congenital fetal anomalies after the gestational age of 20 weeks in Taiwan. Multivariate analysis was done to assess whether the increased risk for adverse perinatal outcomes was due to polyhydramnios or to its significant association with other risk factors.

METHODS

To investigate the relative risks of adverse perinatal outcomes with polyhydramnios, computerized records of women who delivered at Chang Gung Memorial Hospital from July 1990 to December 2001 were retrospectively reviewed to identify pregnant women beyond the 20th week of gestation with polyhydramnios. Pregnancies complicated by congenital fetal anomalies were excluded. Polyhydramnios is defined as an AFI of greater than 24 cm or more by sonography.⁽⁹⁾ AFI measurements were performed as described by Phelane et al.⁽¹⁰⁾ Ultrasonographic screening was performed at 20-24 and 30-34 weeks' gestation and on admission to labor and delivery. If we detected polyhydramnios, the fetuses were screened for gross anomalies by an experienced

sonographer. The women underwent monthly ultrasound examinations to detect the presence or absence of polyhydramnios. Patients with persistent polyhydramnios constituted the polyhydramnios group. Those with a normal amniotic fluid volume (5 cm < AFI < 24 cm) served as the control group.

The perinatal period was defined as a pregnancy after 20 weeks' gestation but before the seventh day after birth. Measurements of adverse perinatal outcomes included the incidences of preterm delivery (less than 37 weeks), low birth weight (less than 2500 gm) or very low birth weight (less than 1500 gm), macrosomia (more than 4000 gm), one- and five-minute Apgar scores less than 7, cord looped around the neck, fetal death, small for gestational age (SGA) (defined as birth weight below the tenth percentile for gestational age) babies,⁽¹¹⁾ large for gestational age (LGA) babies, meconium-stained amniotic fluid, Cesarean section, instrument delivery, fetal distress in labor, neonatal death within the first seven days after birth and admission to a neonatal intensive care unit (NICU) as determined by attending neonatologists.

This study consisted of two steps. The first step was to evaluate the possible confounding factors affecting the occurrence of polyhydramnios. We then investigated the relative risks of this event to adverse perinatal outcome while adjusting for the above variants. Those factors we assumed initially included gravidity, parity, maternal obesity (defined as a body mass index of 24 kg/m² or more before pregnancy), body weight gain more than 20 kg during pregnancy, fetal gender, multiple pregnancy, preeclampsia, diabetes (either overt or gestational), postterm pregnancy (after 42 weeks' gestation), advanced maternal age (older than 34 years), placental abnormalities (placental abruption, placenta previa or placenta accreta⁽¹²⁾) and previous obstetric history (fetal death, preterm delivery, ectopic pregnancy or abortions).

Statistical comparisons were performed using Student's *t* test and multiple logistic regression with backward elimination for variable selection using SPSS for Windows, Release 10.0 (Statistical Package for Social Sciences, Inc., Chicago, IL). Odds ratios (OR) and 95% confidence interval (CI) were calculated when appropriate. A *p* value < 0.05 was considered statistically significant.

RESULTS

Over a 10-year period from July 1990 to December 2001, complete pregnancy outcome information was available for 46,983 women who delivered at Chang Gung Memorial Hospital. Among these patients, 328 patients (0.7%) met the criteria for polyhydramnios, another 46084 (98.1%) had normal amniotic fluid volumes, and the remaining 571 (1.2%) had oligohydramnios. After exclusion of those with a gestational age less than 20 weeks, oligohydramnios and congenital fetal anomalies, 279 patients had polyhydramnios, and 44,478 patients had normal amniotic fluid volumes. The gestational ages at delivery ranged from 20 to 42 weeks. The mean gestational ages at delivery in patients with polyhydramnios and normal amniotic fluid volumes were 37.16 ± 3.72 and 38.53 ± 3.92 weeks, respectively. The mean fetal body weights at delivery in patients with polyhydramnios and normal amniotic fluid volumes were 2929.80 ± 861.04 and 3194.10 ± 496.04 gm, respectively. Both were statistically significant ($p < 0.001$).

Significantly higher incidences of preeclampsia, placental abruption, placenta accreta, past history of fetal death or preterm delivery, multiple pregnancy, bodyweight gain ≥ 20 kg during pregnancy and primiparity were noted in the patients with polyhydramnios (Table 1). There were no significant differences in gravidity, fetal gender, maternal obesity, diabetes (either overt or gestational), postterm pregnancy, advanced maternal age, placenta previa and incidences of previous abortion and ectopic pregnancy between groups.

Table 2 demonstrates the comparisons of

adverse pregnancy outcomes, mode of delivery and neonatal condition after adjusting for the above significant confounding factors. The presence of polyhydramnios significantly increased the rates of preterm delivery, low birth weight or very low birth weight, low one- and five-minute Apgar scores, fetal death, LGA babies, meconium-stained amniotic fluid, Cesarean section and fetal distress in labor. In addition, the incidences of NICU admission and neonatal death in the polyhydramnios group were statistically higher than in the control group. Differences that did not reach statistical significance included macrosomia (birth weight ≥ 4000 gm), cord looped around the neck, SGA babies and instrument delivery.

DISCUSSION

The etiologic factors of polyhydramnios are varied and may include maternal and fetal conditions such as congenital anomalies, diabetes mellitus, isoimmunization, multiple gestations, and placental abnormalities.⁽⁶⁻⁸⁾ But the cause of polyhydramnios remains idiopathic in most cases (60%),^(7,8) and the precise incidence of associated perinatal outcomes is unclear because the definition of polyhydramnios, subjective impression, and quantitative deepest vertical pocket measurement influence the reported incidence of this entity. Adverse perinatal outcomes in patients with polyhydramnios have been associated with congenital fetal anomalies in numerous studies.^(13,14) Despite a relative lack of data on patients with polyhydramnios without associated congenital fetal anomalies, many obstetricians still regard it as an indicator of an adverse outcome in pregnancy, and

Table 1. Significant Confounding Factors Affecting the Occurrence of Polyhydramnios

Confounding factors	Polyhydramnios (N=279)		Control group (N=44478)		Odds ratio	95% CI	p
	N	%	N	%			
Preeclampsia	11	3.9	736	1.7	2.4	1.3-4.5	0.008
Placental abruption	13	4.7	407	0.9	5.3	3.0-9.3	$p < 0.001$
Placenta accreta	7	2.5	167	0.4	6.8	3.2-14.7	$p < 0.001$
Past history of fetal death	7	2.5	416	0.9	2.7	1.3-5.8	0.017
Past history of preterm delivery	14	5.0	479	1.1	4.9	2.8-8.4	$p < 0.001$
Multiple pregnancy	48	17.2	1408	3.2	6.4	4.6-8.7	$p < 0.001$
Body weight gain ≥ 20 kg	40	14.3	4551	10.2	1.5	1.1-2.1	0.026
Primiparity	155	55.6	21350	48.0	1.4	1.1-1.7	0.014

Abbreviation: CI: confidence interval.

Table 2. Association of Polyhydramnios with Adverse Pregnancy Outcome, Mode of Delivery and Neonatal Condition

Pregnancy outcome	Polyhydramnios (N=279)		Control group (N=44478)		Adjusted odds ratio*	95% CI	p
	N	%	N	%			
Preterm delivery<37weeks	71	25.5	3262	7.3	2.4	1.7-3.4	p<0.001
Birth weight<2500 g	63	22.6	2689	6.1	2.2	1.5-3.2	p<0.001
Birth weight<1500 g	27	9.7	453	1.0	4.8	2.9-8.0	p<0.001
Birth weight ≥4000 g	12	4.3	1518	3.4	1.5	0.9-2.8	0.159
1-minute Apgar score<7	45	16.1	1155	2.6	4.0	2.8-6.0	p<0.001
5-minute Apgar score<7	31	11.1	510	1.2	6.0	3.8-9.4	p<0.001
Cord looped around neck	34	12.2	6675	15.0	0.9	0.6-1.3	0.517
Fetal death	9	3.2	204	0.5	4.2	1.9-9.2	p<0.001
Small for gestational age	44	15.8	3084	6.9	1.4	1.0-2.0	0.079
Large for gestational age	46	16.5	5027	11.3	1.8	1.3-2.5	p<0.001
Meconium	56	20.1	4042	9.09	2.8	2.0-3.7	p<0.001
Cesarean section	154	55.2	17313	38.9	1.5	1.1-1.9	0.005
Instrument delivery	17	6.1	2720	6.1	0.9	0.5-1.5	0.649
Fetal distress in labor	10	3.6	225	0.5	4.1	2.0-8.6	p<0.001
NICU admission	52	18.6	1991	4.5	3.1	2.2-4.3	p<0.001
Neonatal death	10	3.6	125	0.3	5.0	2.3-11.0	p<0.001

Abbreviations: NICU: neonatal intensive care unit; CI: confidence interval.

*Adjusted for significant confounding variables.

therefore recommend comprehensive invasive or noninvasive examinations to evaluate the risks of pregnancy. Although we excluded congenital fetal anomalies, our statistical analysis showed that polyhydramnios was more likely in women with preeclampsia, placental abruption, placenta accreta, past history of fetal death or preterm labor, multiple pregnancy, body weight gain more than 20kg during pregnancy and primiparity. After control for these variables, there were increased risks of preterm delivery, low birth weight or very low birth weight, low one- and five-minute Apgar scores, fetal death, LGA babies, meconium-stained amniotic fluid, Cesarean section and fetal distress in labor. From this study, we could not identify a solitary etiologic factor for the adverse perinatal outcome in patients with polyhydramnios.

The characteristic vasoconstriction in women with preeclampsia as a result of uteroplacental insufficiency has been hypothesized as a cause of oligohydramnios.⁽¹⁵⁾ But polyhydramnios has rarely been associated with preeclampsia. The reason preeclampsia and polyhydramnios were associated in this study is probably due to the inclusion of multiple pregnancies in our series. Polyhydramnios carried approximately 5 times the risk of placental abruption

in our series. Sheiner et al. reviewed 72,995 term deliveries and postulated that placental abruption was found to be significantly associated with polyhydramnios.⁽¹⁶⁾ Joseph and Shoham reported diabetes was clinically associated with the occurrence of polyhydramnios.^(17,18) From our current data, the association between polyhydramnios and diabetes was not statistically significant. The inconsistency for diabetes may be due to demographic bias and screening criteria for gestational diabetes. Joseph et al., from their reviews of 40,065 pregnant patients, found diabetic patients had a higher incidence of perinatal mortality and a higher rate of Cesarean section. On the contrary, Shoham et al. suggested gestational diabetes complicated by polyhydramnios was not associated with increased risks of perinatal morbidity and mortality. Primiparity was also found to be a significant confounding factor affecting polyhydramnios in our series. Goldman et al. reported the incidence of polyhydramnios was not significantly different among grandmultiparous (five or more deliveries), primiparous and multiparous (two to three previous deliveries) women.⁽¹⁹⁾ But our results did not support the above findings. Maternal weight gain over 20 Kg was also a significant confounding factor in our series. This may be due to the high inci-

dence of multiple pregnancies in patients with polyhydramnios in our study. Other studies also reported a higher maternal weight gain in multiple pregnancies.⁽²⁰⁾ In addition, we observed the severity of maternal weight gain significantly increased the incidence of polyhydramnios. A higher rate of past history of fetal death or preterm delivery was also noted in patients with polyhydramnios. Detailed prenatal surveillance of the amount of amniotic fluid may be warranted in subsequent pregnancies for these patients.

The prevalence of preterm delivery in polyhydramnios was higher than in the general population. But prematurity alone did not account for the adverse perinatal outcomes because the mean gestational age and fetal body weight for women with polyhydramnios were 37.16 ± 3.72 weeks and 2929.80 ± 861.04 gm, respectively. Several other underlying causes inducing polyhydramnios, rather than the relative excess of amniotic fluid, appear to be associated with adverse perinatal outcomes. Placental anomalies (either placental abruption or placenta accreta) and multiple pregnancies were the two major underlying causes of adverse perinatal outcome from our analysis (Table 2). Unlike oligohydramnios, polyhydramnios is rarely associated with fetoplacental dysfunction.⁽¹⁵⁾ Therefore polyhydramnios was not significantly associated with SGA neonates as in our study of oligohydramnios.⁽²¹⁾ Sickler et al. evaluated 39 fetuses with polyhydramnios who were small for gestational age⁽²²⁾ and observed that major congenital anomalies were present postnatally in 92% (36 of 39) of fetuses and chromosome abnormalities were present in 38% (15 cases). Congenital anomalies and chromosomal abnormalities were the principal causes of SGA. We excluded congenital fetal anomalies in our initial criteria and this was possibly the main reason that polyhydramnios was not significantly associated with SGA babies. From our study, the prevalence of LGA neonates was 1.79 times greater in patients with polyhydramnios than in patients with normal amniotic fluid volume. A previous study relating polyhydramnios and the prevalence of LGA babies showed that patients with polyhydramnios have a significantly higher prevalence of LGA neonates (27%) than controls (10%).⁽²³⁾ Results from our analysis support the above findings. In spite of the significant association between polyhydramnios and LGA babies, we did not observe an association

between polyhydramnios and macrosomia. This finding was compatible with the lack of association between polyhydramnios and diabetes in our study. Furthermore, we also observed that patients with polyhydramnios carried a 2.76 higher risk of meconium-stained amniotic fluid. But a previous report by Blackwell suggested meconium-stained amniotic fluid does not appear to be associated with amniotic fluid amount in term pregnancies.⁽²⁴⁾ The difference was partially attributed to difficulties in quantitative assessment of meconium-stained amniotic fluid.

Based on data from a relatively small number of patients with idiopathic polyhydramnios, Panting-Kemp et al. reported polyhydramnios was not significantly associated with a greater risk of preterm delivery (<37 weeks), very low birth weight (<1500gm), 5-minute Apgar score <7, NICU admission or perinatal death.⁽⁵⁾ But they found a significant difference in macrosomia and a higher incidence of Cesarean section, which were somewhat compatible with our findings. However, we observed that polyhydramnios had a significant association with preterm delivery, low and very low birth weight (<2500gm), low Apgar score <7, fetal death, LGA neonates, meconium-stained amniotic fluid, fetal distress in labor, NICU admission and neonatal death. The contradiction may be related to the larger population and more appropriate statistical analysis in our series. Surprisingly, despite exclusion of congenital anomalies, we found a three to six-fold risk of low Apgar score, fetal death, fetal distress in labor, NICU transfer and neonatal death in patients with polyhydramnios. This means that detailed antepartum fetal well-being surveillance, intensive intrapartum fetal monitoring, and further postpartum attention by a neonatologist are warranted in patients with polyhydramnios.

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懷孕超過二十週合併有羊水過多但無胎兒先天性畸型的 周產期預後

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背景：目前缺乏有關亞洲民族懷孕合併有羊水過多的周產期預後的大規模研究。本篇的目的即是研究臺灣地區懷孕超過二十週合併有羊水過多，但無胎兒先天性畸型的孕婦，評估其胎兒的周產期預後。

方法：將1990年7月到2001年12月懷孕超過二十週合併羊水過多，但無胎兒先天性畸型的孕婦病歷作回溯性地整理。第一步先將可能與羊水過多相關的因素作分析，第二步再用這些有意義的相關因素，評估其周產期預後。

結果：與羊水過多的相關因素有八項。羊水過多的孕婦常有早產，胎兒體重小於2500及1500公克或胎兒體重過重之情況。待產時急性胎兒窘迫、剖腹產、出生後一分及五分鐘Apgar score低、胎死腹中及羊水含有胎便的機率增高。新生兒轉送加護病房及新生兒死亡之機率增高。

結論：即使將先天性畸型的胎兒排除，其他合併羊水過多的胎兒仍有較差的周產期預後。我們必需在產前對胎兒健康情況詳細地檢查，待產時密切監視及產後高度注意新生兒的各種狀況。

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關鍵字：羊水過多，周產期預後。