

Polyhydramnios

Risk factors and outcome

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ABSTRACT

الأهداف: تحديد عوامل الخطورة المصاحبة لكثرة السائل الامنيوسي وتقدير النتائج بالنسبة للأم وفترة ما قبل الولادة في هؤلاء المرضى.

الطريقة: هذه دراسة مستقبلية تضمنت كل الولادات المصحوبة بزيادة في السائل الامنيوسي التي تمت في مستشفى جامعة السلطان قابوس في سلطنة عمان في فترة ستة عشر شهرا في الفترة ما بين الأول من يناير ٢٠٠٥ وحتى الثلاثين من شهر ابريل ٢٠٠٦ م. قسمت زيادة السائل الامنيوسي إلى بسيطة ومتوسطة إلى شديدة معتمدة على قيمة معدل السائل الامنيوسي. تم دراسة المعلومات الديموغرافية للمريضات، مضاعفات ما قبل الولادة، أعمار الأجنة عند الولادة، طرق الولادة، مضاعفات ما بعد الولادة، إضافة إلى نتائج فترة ما حول الولادة.

النتائج: كان مجموع الولادات التي حدثت في فترة البحث ٢٦٤٨ ولادة من ضمنهن ٢٠٨ ولادة (٧,٨٪) مصحوبة بزيادة في السائل الامنيوسي كانت ضمن مجموعة البحث و ٢٤٤٠ حالة حمل طبيعية أي بمعدل طبيعي للسائل الامنيوسي هي مجموعة التحكم للدراسة. كانت زيادة السائل الامنيوسي بسيطة في ١٧٩ حالة (٨٦,١٪) ومتوسطة إلى شديدة في ٢٩ حالة (١٣,٩٪). كانت ٦٨ ولادة من هذه الولادات (٣٢,٧٪) مصحوبة بمرض السكري مقارنة ب ١٢,٤٪ في مجموعة المقارنة. لوحظ معدل الولادة المبكرة في ١٦ حالة (٧,٧٪) كما كان معدل حدوث الولادات القيصرية ٢٧,٩٪ في مجموعة البحث مقابل ١٧,٣٪ في مجموعة المقارنة. التشوهات الخلقية الشديدة وجدت في ٢,٨٪ من المواليد مقارنة ب ١٪ في مجموعة البحث. تم ترقيد ١٨ طفل في وحدة العناية المركزة لحديثي الولادة.

خاتمة: الدراسة أثبت وبشكل قاطع بأنه هناك علاقة إيجابية بين مرض السكري في الحمل وتقدم عمر الأم أهم عاملي خطورة لحدوث زيادة السائل الامنيوسي. لقد وجدنا زيادة ذات حثية في وزن الجنين عند الولادة مصاحبا لزيادة معدل السائل الامنيوسي. كما كان فقر الدم (الأنيميا) في الحمل وزيادة وزن الجنين ومعدل حدوث الولادات القيصرية وزيادة التشوهات الخلقية أعلى من المؤلف في المجموعة قيد البحث.

Objectives: To determine the risk factors associated with polyhydramnios, and assess the maternal and perinatal outcome in these patients.

Methods: A prospective study of all deliveries complicated with polyhydramnios in Sultan Qaboos University Hospital, Sultanate of Oman between January 2005 and April 2006. Polyhydramnios was divided into mild and moderate to severe based on the amniotic fluid index values. The demographic data, antenatal complications, gestational age at delivery, mode of delivery, postpartum complications, and perinatal outcome were studied.

Results: A total of 2648 singleton deliveries occurred during the study period. Two hundred and eight (7.8%) women with polyhydramnios formed the study group, and 2440 women with normal amniotic fluid formed the control. Polyhydramnios was mild in 179 (86.1%) and moderate to severe in 29 (13.9%) cases. Sixty-eight (32.7%) of these pregnancies were complicated with diabetes as compared with 12.4% of the controls. Preterm delivery occurred in 16 (7.7%) cases. Cesarean delivery rate was 27.9% in the study group compared with 17.3% in the control. Major congenital anomalies were found in 2.8% of newborns compared with 1% among the controls. Eighteen babies were admitted to the special care baby unit.

Conclusion: These data demonstrates a significant positive relation with maternal age, diabetes in pregnancy, and fetal macrosomia with polyhydramnios. Anemia during pregnancy, cesarean delivery rate, and congenital anomalies were significantly higher in the study group.

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Estimation of amniotic fluid volume, using ultrasound to calculate the amniotic fluid index (AFI) as the 4-quadrant sum of amniotic fluid pockets, has become an integral part of fetal surveillance.^{1,2} An AFI that is too high according to various standards indicates polyhydramnios, and is reported to occur in 1-3% of all pregnancies.³ Polyhydramnios is associated with maternal diabetes, multiple pregnancy, fetal and placental anomalies, and immune and non-immune hydrops, however in many cases, available tests reveal no etiology and the cause remains idiopathic.^{3,4} Many reports have documented an increased risk of fetal compromise and adverse perinatal outcome in pregnancies complicated by polyhydramnios, however it remains controversial if the underlying cause or the relative excess of amniotic fluids of unexplained etiology, or both, are the main determinants of an increased incidence of adverse perinatal events.^{3,5} If polyhydramnios is an independent risk factor, continuing fetal surveillance is warranted in those patients even in the absence of known causal risk factors. The aim of our study is to evaluate the obstetric and perinatal outcome of pregnancies complicated by polyhydramnios in the third trimester of pregnancy.

Methods. An observational cohort study including 2648 women with singleton pregnancy that delivered in Sultan Qaboos University Hospital, Muscat, Oman, between January 1st 2005 and April 30th 2006. All women underwent transabdominal ultrasonographic examination as part of routine fetal surveillance in the third trimester of pregnancy using real-time ultrasound equipment with 3.5 MHz curve-linear array transducer (Siemens G60, Germany). For AFI measurement, the uterus was divided into 4 quadrants with the left and right halves on both sides of the linea nigra, and the upper and lower halves divided by an imaginary horizontal line midway between the fundus of the uterus and the symphysis. The maximum vertical dimension of the largest fluid pocket in each of the 4 quadrants without umbilical cord or fetal small parts was measured in millimeters, and summed to form the AFI.⁶ Polyhydramnios was defined as an AFI value of 200 mm or more, and was divided into as mild (200-299 mm), moderate (300-349 mm), and severe (more than 350 mm).⁷ Two hundred and eight women with singleton pregnancy with gestational age ranging from 28-42 was included in the study. Of these, 179 (86.1%) had mild polyhydramnios and 29 (13.9%) had moderate to severe polyhydramnios. Multiple pregnancies and pregnancies before 28 weeks were excluded from the study. As it was difficult to get matched controls, all women with singleton pregnancy with normal AFI during the study period was taken as the control. The study was approved by the ethics committee of

the hospital, and written consent from the patients was obtained. Cases and controls were compared for maternal characteristics and for risk factors known to be associated with polyhydramnios (such as maternal diabetes mellitus [DM], iso-immunization, congenital anomalies). Antenatal complications, gestational age at delivery, mode of delivery, postpartum complications, and perinatal outcomes were compared with the controls. All women with polyhydramnios were tested for blood group iso-immunization and underwent comprehensive ultrasound examination to detect fetal anomalies. A 75 gm 2-hour oral glucose tolerance test was carried out in all women without preexisting DM. A diagnosis of gestational diabetes was confirmed according to the departmental guidelines (fasting cut off value of ≥ 5.8 mm and/or 2-hour value of ≥ 7.8 mm). Patients with gestational diabetes were managed with diabetic diet and insulin added whenever needed. A hemoglobin level less than 10gm/dl was considered as anemia during pregnancy. Cesarean (CS) delivery rate and indications were analyzed. Postpartum hemorrhage was defined as a blood loss of >500ml after vaginal delivery or 1000ml after CS delivery. Neonatal outcome was assessed by 5-minute Apgar score and need for admission to the special care baby unit (SCBU).

Statistical Package for the Social Sciences version 10 was used for the statistical analysis. Chi-square test was applied to find the association between the characteristics of polyhydramnios and for a lower prevalence, Z-test for proportion was used for testing the significance of the difference between cases and controls. A *p*-value of 0.05 or less was taken as significant.

Results. A total of 2648 singleton deliveries occurred during the study period of 16 months. The rate of polyhydramnios was 208 (7.8%). The percentage of mild polyhydramnios such as AFI less than 300 mm was 179 (86.1%), and moderate to severe (AFI more than 300 mm) was 29 (13.9%). Ninety percent (188) of the study group were Omanis and the rest were from other countries.

The mean maternal age was 30.1 ± 5.12 years. Mothers 35 years and older formed 15.9% (33) of the study group. There was a significant increase in AFI with rising maternal age ($p < 0.034$). Thirty-one patients (15%) were nulliparous and the highest parity was 13. The analysis of parity distribution did not reveal any significant trend with AFI. The incidence of diabetes in the study group was 32.7%, out of this 49 (72%) patients were only on diet control. The incidence of diabetes in the group without polyhydramnios was 12.4% ($p < 0.00001$). Only 4 patients had preexisting DM. Forty-five patients (21.6%) had anemia, compared to 6.4% in the control group ($p < 0.0001$). Four patients had pregnancy-induced hypertension, and 5 patients

were rhesus (Rh)-negative. Out of the 5 Rh-negative women with polyhydramnios, 2 were iso-immunized.

The mean gestational age at delivery was 38.6 ± 1.2 weeks. Sixteen (7.7%) deliveries occurred before 37 weeks of gestation and seventeen (8.2%) after 41 weeks of gestation. The CS delivery rate was 27.9%, compared to 17.3% among the controls ($p < 0.0001$). Out of these, 24 (11.5%) had elective CS for various indications and 34 (16.3%) had emergency CS. The main indication for emergency CS was non-reassuring fetal status (12 cases), others were repeat CS, and malpresentations. Seven (3.4%) of the study group had instrumental deliveries compared to 2.4% among the control. Most of these were ventouse deliveries. This difference was not statistically significant. Postpartum hemorrhage occurred in 2.9% cases, and all were after the CS deliveries. The rate of macrosomic babies (birth weight ≥ 4000 gm) was 9.6% in the study group compared to 3.2% in the control ($p < 0.0001$). The mean birth weight was 3302 ± 543 gm and the heaviest newborn was 4720 gm, born to a 5th gravida at 38 weeks of gestation by emergency CS. A significant positive relationship was observed between AFI and birth weight ($p < 0.008$).

Only 2 babies in the study group had a 5 minute Apgar score of less than 7, one was with multiple congenital anomalies and the other with Edward's syndrome. There were 4 cases of shoulder dystocia in this group, none of them had any neurological damage. The rate of major congenital anomalies was 2.8% in the study group compared to 1% in the control ($p < 0.05$). All of them were associated with AFI more than 250 mm. Prevalence rate and 95% confidence interval of different observations among the study group and control are shown in **Table 1**. **Table 2** shows the subgroup analysis of the polyhydramnios cases. The details of congenital anomalies are summarized in **Table 3**. Eighteen babies were admitted to SCBU with perinatal asphyxia, shoulder dystocia, hypoglycemia, and congenital anomalies. Six babies were diagnosed to have pelvi-ureteric junction dilatation antenatally, 5 babies recovered fully; one had persistent left ureteric obstruction resulting in left hydronephrosis and systemic hypertension.

Perinatal mortality in this group was 14.4/1000 compared to 6/1000 in the controls. There was one intrauterine and 2 neonatal deaths. Intrauterine death occurred in a multi-gravida with essential hypertension and gestational diabetes controlled by diet alone. Polyhydramnios (AFI 276 mm) was diagnosed at 29 weeks of gestation, she did not have any antenatal check ups after that, and came with severe pre-eclampsia and intrauterine fetal death at 37 weeks gestation. She delivered a macerated baby weighing 2530 gm without any gross external anomalies. One baby died at the age of 11 days due to complex congenital heart disease; mother had uncontrolled DM. The other baby died at the age of 28 days due to Edward's syndrome.

Discussion. Although a great deal is known on the causes and prognosis of low amniotic fluid volume, much less is known on polyhydramnios. The cause of polyhydramnios remains idiopathic in most cases, and the precise incidence of associated maternal and fetal disease is unknown. Many clinicians have viewed polyhydramnios as a prognostic indicator of increased risk of pregnancy complications and have recommended extensive evaluation of these pregnancies, including multiple comprehensive ultrasound examinations, repeat diabetic screening, and amniocentesis for fetal karyotype analysis.^{8,9}

The 4-quadrant amniotic fluid measurement suggested by Phelan *et al*⁶ is the most widely accepted method for estimation of amniotic fluid volume. A >25 cm (250 mm) cut off is used by most authors for the diagnosis. Ott,⁵ in his study of the relationship between amniotic fluid volume and perinatal outcome found that a >25 cm cut off was a more sensitive indicator of risk for abnormalities than the >18 cm cut off. In Oman, a 20 cm cut off is used for the diagnosis of polyhydramnios. As a result, the prevalence of polyhydramnios is much higher; 7.8% as compared to 1-3% in most of the studies using a >25 cm cut off.⁴ The demographic analysis showed that polyhydramnios was more common in older gravidas, however parity had no significant relation with AFI. Biggio *et al*,³ in his study of 370 women with polyhydramnios found a significant relation with rising maternal age and parity with amniotic fluid volume.

There is a well-established correlation between DM and polyhydramnios, especially if the diabetes is poorly controlled. Dashe *et al*¹⁰ demonstrated increased amniotic fluid glucose levels in patients with poorly controlled diabetes, supporting the hypothesis of osmotic diuresis as the main reason for polyhydramnios in such pregnancies. It has been reported that approximately 15% of pregnancies complicated by polyhydramnios occur in diabetic women.¹¹ In our study group, 32.7% had gestational diabetes, compared to 12.4% among the controls. The incidence of anemia was significantly higher in our study group; this was not previously reported as a risk factor for polyhydramnios. More studies are needed to look for the relationship between maternal anemia and polyhydramnios. There was no significant increase in preterm delivery, abruptio placenta, or low 5 minute Apgar score in these women. This study showed a strong relationship between birth weight and polyhydramnios as noted by other authors.¹² Vink *et al*¹³ in a recent study on AFI and birth weight, demonstrated that the relationship between macrosomia and polyhydramnios is linear across birth weights in diabetic patients with poor glycemic control. The increase in cesarean delivery rate was mainly due to an increase in elective cesareans

Table 1 - Prevalence rate and 95% confidence interval (CI) for different parameters among polyhydramnios and control, and their significance.

Complications	Case (n = 208)		Control (n = 2440)		P-value
	%	95% CI	%	95% CI	
Diabetes	32.7	26.3 - 39.1	12.4	11.1 - 13.7	<0.001*
Anemia	21.6	16 - 27.2	5.1	4.2 - 6	<0.001*
Rhesus negative	2.4	0.32 - 4.5	2.3	1.7 - 3	NS
Preterm delivery	7.7	4.1 - 11.3	6.7	6 - 8	NS
Cesarean section	27.9	21.8 - 34	17.3	15.8 -18.8	<0.001*
Macrosomia	9.6	5.6 - 13.6	3.2	2.5 - 4	<0.001*
Low Apgar	1.9	0.04 - 3.8	1.1	0.69 - 1.5	NS
Special care baby unit admission	12.5	8 - 17	7.1	6 - 8.1	<0.01*
Congenital anomaly	2.8	0.56 - 5	1	0.6 - 1.4	<0.05*

*significant, NS - non-significant.

Table 2 - Sub-group analysis of polyhydramnios cases

Parameters	Mild (n = 179)	Moderate to severe (n = 29)
	%	%
Diabetes	30.7	44.8
Anemia	21.2	24.1
Cesarean section	26.3	38.0
Macrosomia	9.0	13.8
Congenital anomaly	5.6	10.6

All values expressed are non-significant.

Table 3 - Major congenital anomalies and the outcome.

Anomaly	Parity	Diabetes	AFI	Mode of delivery and GA	BW	5 minute Apgar	Outcome
Left ureteric obstruction	5	-	258	SVD 38weeks	3190	10	Left hydro-nephrosis, low uptake and hypertension
Hypoplastic left heart syndrome, large PDA	4	IDDM	304	LSCS 34 weeks	3140	9	Complex heart disease, died on the 11 th day.
Prominent lateral and 3 rd Ventricle, prominent bowel loops	9	-	348	LSCS 36 weeks	1740	6	Edward's syndrome, died on the 28th day.
Multiple fracture in limbs	2	-	261	SVD 40 weeks	2815	10	Osteogenesis imperfecta.
Intracranial calcification, dysmorphic features, PDA	3	GDM on diet	253	LSCS 36 weeks	2300	3	Subcortical and bifrontal periventricular calcification, delayed mile stones
Right ectopic kidney	0	-	204	SVD 40 weeks	2650	8	Right ectopic kidney with VUR

AFI - amniotic fluid index, GA - gestational age, BW - birth weight, SVD - spontaneous vaginal delivery, PDA - patent ductus arteriosus, IDDM - insulin dependent diabetes mellitus, LSCS - lower segment cesarean section, GDM - gestational diabetes mellitus, VUR - vesico ureteric reflux

due to macrosomia and suspected fetal compromise during labor. The significant increase in cesarean delivery rate in polyhydramnios was also noted by other authors.^{3,5} Instrumental delivery rate and postpartum hemorrhage were not significantly different from the control. Congenital anomalies were significantly higher in the study group; all major anomalies were associated with an AFI of more than 250 mm. A large study by Morris et al¹⁴ found that AFI has a poor sensitivity for adverse pregnancy outcome, and was likely to lead to increased obstetric intervention without improving outcome.

In conclusion, increasing maternal age and gestational diabetes were the main antenatal risk factors for polyhydramnios. The main limitation of the study is the definition of polyhydramnios used, which makes comparison with other studies difficult. Those with polyhydramnios should be tested for diabetes, and have a comprehensive ultrasound examination to rule out congenital anomalies. Idiopathic polyhydramnios is associated with adverse pregnancy outcome, and continuing fetal surveillance is warranted even in the absence of known risk factors.

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