

# Polyhydramnios as a Predictor of Adverse Pregnancy Outcomes

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## مَوْه السَّلَى كَمَتَبِي لَتَعَسَر نَتَائِج الحَمَل

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**المخلص:** الهدف: تهدف هذه الدراسة إلى التحقق من مَوْه السَّلَى المتكررة في الحمل المفرد، تحليل العوامل المرتبطة بالمخاطر المتعلقة بالحمل وتقييم النتائج الامومية والولادية المضادة. الطريقة: تم القيام بدراسة إستيعادية لمجموعة الحالات المؤديه الى تعقيدات داء موه السلي في كل حالات الحمل المفرد بعد الأسبوع 28 من الحمل. تم إجراء هذه الدراسة في قسم النساء والولادة بمستشفى نزوى، عمان من يناير 2002 إلى ديسمبر 2007. من عدد 25,979 حالة حمل تم استعراضها، وجد أن 477 تعاني من داء موه السلي. مجموعة التحكم تكونت من 900 امرأة حامل. حالات داء موه السلي تم تشخيصها على أنها خفيفة، معتدلة أو شديدة مستندة على مؤشر الكمية القصوى من السائل السلوي. تمت المقارنة بين الحالات المصابة ومجموعة التحكم طبقاً للبيانات السكانية، داء السكر، داء عملاقة الجنين، الولادة القيصرية، تكرار الأجنة الشاذة و معدل وفيات الأجنة. النتائج: تم تشخيص داء موه السلي في 1.8% من معدل النساء الحوامل. وكانت خفيفة في 382 حالة (80%)، معتدلة في 84 حالة (17.6%) وشديدة في 12 حالة (2.4%). 72 (15.3%) حالة من إجمالي حالات داء موه السلي كانت معقدة بالإصابة بداء السكري (الحمل أو السكري المشخص) مقارنة ب 10% في مجموعة التحكم، مع وجود 39 (8.1%) ولید مصاب بتشوهات خلقية. داء موه السلي كان مرتبطاً بتقدم عمر الأم، وكان عمر 58 (12.2%) من الحالات أكبر من 40 سنة. معدل وفيات المواليد في الحوامل المصابات بداء موه السلي كانت 42 حالة لكل 1000 مولود مقارنة ب 14 حالة لكل 1000 مولود في مجموعة التحكم. الخلاصة: هذه البيانات تشير إلى وجود ارتباط بين داء موه السلي وزيادة مخاطر النتائج العكسية للحمل، وكذلك وجود علاقة إيجابية فيما يتعلق بعمر الأم، الإصابة بداء السكري، تشوهات الجنين وداء عملاقة الجنين.

**مفتاح الكلمات:** مؤشر السائل السلوي، الولادة القيصرية، عملاقة الجنين، النتيجة الولادية، عمان.

**ABSTRACT: Objectives:** This study aimed to ascertain the frequency of polyhydramnios in singleton pregnancies, to determine the associated risk factors, and assess the adverse maternal and perinatal outcomes. **Methods:** A retrospective cohort study of all singleton pregnancies complicated with polyhydramnios after 28 weeks of gestation was carried out in Nizwa Hospital's Obstetrics & Gynecology Department, Oman, from January 2002 to December 2007. Of 25,979 pregnant women reviewed, 477 were found to have polyhydramnios. The control group consisted of 900 pregnant women. Cases of polyhydramnios were diagnosed as mild, moderate, or severe based on their highest amniotic fluid index. Cases were compared with controls in terms of demographic data; prevalence of diabetes, macrosomia, or Caesarean deliveries; frequency of fetal anomalies, and perinatal mortality rate. **Results:** Polyhydramnios was diagnosed in 1.8% of pregnancies. It was mild in 382 (80%), moderate in 84 (17.6%), and severe in 12 (2.4%). A total of 72 (15.3%) cases of polyhydramnios were complicated by diabetes (gestational or established diabetes mellitus) as compared to 10% of the control group and 39 (8.1%) neonates had congenital anomalies. Polyhydramnios was associated with advanced maternal age; 58 (12.2%) of subjects were over 40 years old. The perinatal mortality rate with polyhydramnios was 42 per 1,000 births compared to 14 per 1000 births in the control group. **Conclusion:** These data demonstrate that polyhydramnios is associated with an increased risk of adverse perinatal outcomes, and there is a significant positive relation with maternal age, diabetes, fetal anomalies, and fetal macrosomia.

**Keywords:** Amniotic fluid index; Caesarean delivery; Macrosomia; Perinatal outcome; Oman.

### ADVANCES IN KNOWLEDGE

- Polyhydramnios occurs in 1–3.5% of pregnancies and is severe in 2.4% of these.
- The principal factors associated with polyhydramnios includes fetal malformation, maternal diabetes mellitus, and multiple gestations.
- The majority of cases of polyhydramnios are idiopathic.

**APPLICATION TO PATIENT CARE**

- *The obstetrician needs to consider a thorough evaluation of the fetus for congenital anomalies when mothers suffer from polyhydramnios during pregnancy.*
- *Close attention should be paid during the antepartum, intrapartum and postpartum periods to anticipate complications of polyhydramnios.*

**P**OLYHYDRAMNIOS REFERS TO AN excessive accumulation of amniotic fluid, which is associated with an increased risk of adverse pregnancy outcomes.<sup>1</sup> Polyhydramnios is diagnosed when a mother's amniotic fluid index elevates to  $>24 \pm 2$  cm standard deviation (SD) in the late second or third trimester.<sup>2</sup> It complicates 0.4–1.9% of all pregnancies.<sup>3</sup> The aetiology of polyhydramnios is diverse and involves many maternal and fetal conditions including diabetes, congenital anomalies, multiple gestation, and isoimmunisation. If none of these causes can be identified, then a diagnosis of idiopathic polyhydramnios is made. Magann reported the incidence of idiopathic polyhydramnios among subjects with polyhydramnios as 50–60%.<sup>4</sup> However, it consistently has been documented that perinatal morbidity and mortality rates increased in association with polyhydramnios related to specific causes.<sup>5,6</sup>

A pregnancy complicated by polyhydramnios can present difficult diagnostic and therapeutic dilemmas for obstetricians. Many clinicians have viewed polyhydramnios as a prognostic factor of increased risk of pregnancy complications and have recommended an extensive evaluation of these pregnancies, including multiple comprehensive ultrasound examinations, repeat diabetes screening, and amniocentesis for fetal karyotyping. However, counselling of a couple regarding idiopathic polyhydramnios often creates significant anxiety and fosters the impression of an abnormal pregnancy.<sup>7</sup>

The rationale of our study was to determine the association between polyhydramnios and adverse obstetric and perinatal outcomes in singleton, third-trimester pregnancies.

## Methods

This was a retrospective cohort study of 25,979 women with singleton pregnancies who delivered at Nizwa Hospital between January 2002 and

December 2007. Permission was first gained from the Research and Ethics Committee of Nizwa Hospital, which is a secondary care hospital serving as a regional referral center for the Al-Dakhliya central region in Oman. The study group was composed of 477 women with polyhydramnios, while 900 women with normal amniotic fluid levels formed the control group, which was selected randomly.

Included in the study were women at 28 or more weeks' gestation with confirmed polyhydramnios in singleton pregnancies who had been diagnosed by ultrasound examination. Pregnancies of less than 28 weeks' gestation and multiple pregnancies were excluded.

Polyhydramnios was categorised as mild, moderate, or severe based on an amniotic fluid index of 25–30 cm, 30.1–35 cm, or 35.1 cm or more, respectively.<sup>8</sup>

Pregnancies were evaluated using abdominal ultrasound examinations as a part of routine fetal surveillance in the third trimester of pregnancies by realtime ultrasound equipment with a 3.5 MHz curve linear array transducer (Koninklijke Philips Electronics, Eindhoven, Netherlands). The frequency of the following were also measured during the study: congenital anomalies, macrosomia (defined as a birthweight of  $\geq 4000$  grams), preterm deliveries (defined as birth occurring from 24 + 0 weeks to less than 36 + 6 weeks of gestation), Caesarean delivery rates, and perinatal mortality (defined as all stillbirths and deaths in the first week after birth).<sup>9,10</sup>

When polyhydramnios was diagnosed, an ultrasound examination was done to detect possible structural anomalies. A 75 gram 2 hour oral glucose tolerance test was carried out in all women without pre-existing diabetes mellitus. Diagnosis of gestational diabetes was confirmed according to Oman's national and WHO guidelines (a fasting cut off value of  $>5.8$  mmol/L or above, 2 hour value  $>7.8$  mmol/L or above). Cases and controls were compared for maternal characteristics

**Table 1:** Demographic data of study subjects

Characteristics	Polyhydramnios (n = 477)		Control (n = 900)		P value
	n	%	n	%	
Nulliparous	90	18.9	130	14.5	0.31
Multiparous	287	60.2	560	62.2	0.15
Grand multiparous	100	20.9	210	23.3	0.26
Mean maternal age (years)	30.1 ± 5.1	NS	28.2 ± 4.3	NS	NS
Maternal age >40 years	58	12.2	34	3.7	<0.001
Diabetes mellitus	73	15.3	89	9.8	<0.001

NS = non-significant

Grand multiparity = >6 parity; Multiparous = 2–6 parity; Nulliparous = 0 parity.

and risk factors known to be associated with polyhydramnios, including diabetes, macrosomia, and congenital anomalies.

Caesarean delivery rates and perinatal outcomes in the study group were compared with those of the control group. Neonatal information was obtained using the computerised obstetric database, which contains pregnancy outcomes for all women who have delivered at our hospital. Evaluation for major congenital anomalies was routinely carried out in the immediate neonatal period by attending pediatricians. Karyotype analysis was performed at the pediatricians' discretion. No women had genetic amniocentesis during the antenatal period as we do not have the facilities for such testing. The control group included singleton pregnancies at  $\geq 28$  weeks of gestation who were evaluated during the study period and exhibited normal amniotic fluid levels upon ultrasound.

The Statistical Package for the Social Sciences (SPSS), Version 10 (IBM, Inc., Chicago, Illinois, USA) was used for statistical analysis. The rate of each specific outcome measure was calculated for patient and control subjects and rates were

compared with Pearson's chi-square test. Statistical significance was defined as  $P < 0.05$ .

## Results

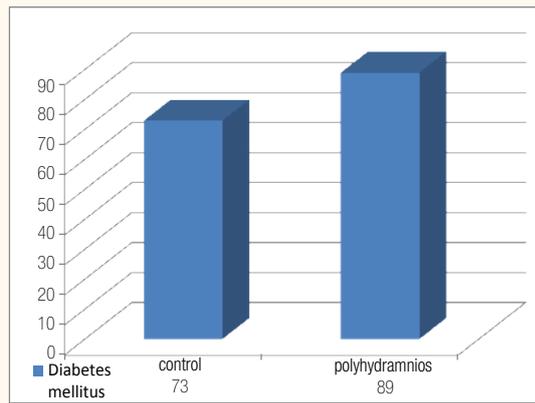
Of the 25,979 singleton pregnancies seen at the hospital during the study period, 477 (1.8%) were diagnosed with polyhydramnios by ultrasound scan. Of those diagnosed, the severity was classified as mild, moderate, and severe in 80.1%, 17.6%, and 2.4% of cases, respectively. From our data, we were able to determine three prominent aetiological classifications of polyhydramnios: idiopathic polyhydramnios occurring in 76.8% of cases; diabetes mellitus, occurring in 15.3% of cases; and congenital anomalies, found in 8.2% of cases.

The demographic data for the control and study groups are displayed in Table I. There was a significant rise in polyhydramnios with advanced maternal age ( $P < 0.001$ ). The analysis of parity distribution did not reveal any significant trend with polyhydramnios.

The cohorts of women were evaluated for diabetes, maintaining the view that there is an

**Table 2:** Outcome measures for study subjects

Outcome measure	Polyhydramnios (n = 477)		Control (n = 900)		P value
	n	%	n	%	
Preterm delivery (<37 weeks)	20	4.1	60	6.6	0.62
Macrosomia (>4000 g)	90	18.8	50	5.5	<0.003
Caesarean delivery	115	24.0	96	10.6	<0.001
Congenital anomalies	39	8.2	39	4.3	<0.001
Perinatal mortality rate	42/1000		14/1000		<0.001

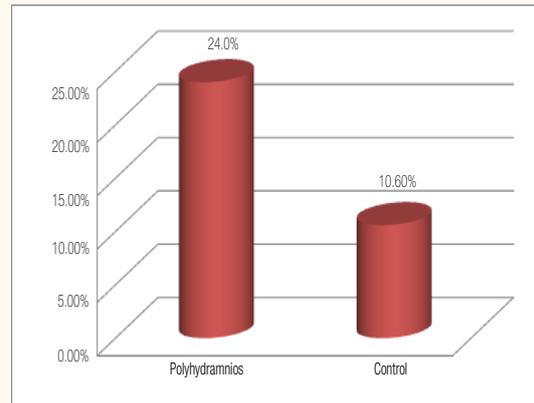


**Figure 1:** A comparison of diabetes mellitus between polyhydramnios and control groups.

established association between diabetes and polyhydramnios. The prevalence of diabetes in the control group was 9.8%, while in the polyhydramnios group it was 15.3% ( $P < 0.001$ ) [Figure 1]. Of those patients, 59 were on a medically supervised diet and 12 were on insulin. Only two patients had pre-existing diabetes, as shown in Figure 1. The difference is statistically significant.

There were 115 Caesarean sections in the study group, yielding a 24% rate of Caesarean delivery *versus* a 10.6% rate in the control group ( $P < 0.001$ ), as shown in Figure 2. Eight (1.6%) of those in the study group had instrumental delivery as compared to 2.4% in the control group. Most of those were vacuum deliveries. Outcome measures are shown in Table 2.

As regards neonatal and fetal outcomes, Figure 3 details the major congenital anomalies that were detected in the infants of 39 women with polyhydramnios (8.2%), while in the control group 4.3% displayed anomalies ( $P < 0.001$ ). Central nervous system (CNS) anomalies included hydrocephaly, anencephaly, holoprosencephaly, and myelomeningocele; these were diagnosed in 12 pregnancies. Gastrointestinal anomalies included oesophageal and duodenal atresia, diaphragmatic hernia, and trachea esophageal fistula; they were diagnosed in 10 pregnancies. Eight pregnancies had cardiovascular malformations including structural cardiac defect, hydrops, and pulmonary oedema. Four fetuses had multi-organ system malformations including those of the central nervous system, and the gastrointestinal and genitourinary systems. Inherited disorders of renal functioning are a rare cause of polyhydramnios. In our study, we diagnosed



**Figure 2:** A comparison of Caesarean section rates between control and polyhydramnios groups.

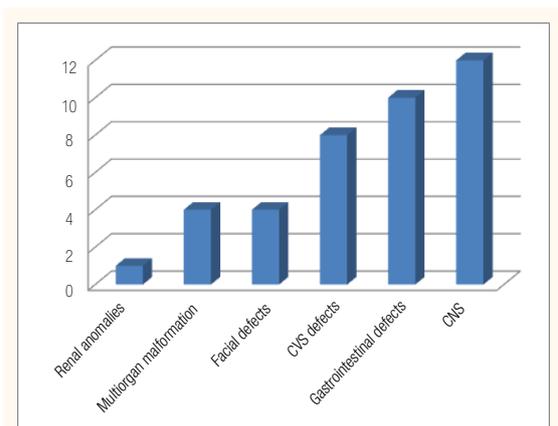
one baby with Bartter syndrome whose mother had uncontrolled diabetes mellitus. The infant died after 11 days due to associated complex cardiac disease.

In regard to macrosomia, the mean birth weight was  $3,800 \pm 300$  grams in the polyhydramnios group, while in the control group it was  $3,000 \pm 300$  grams. The heaviest newborn was 5,000 grams, born to a 7<sup>th</sup> gravida at 41 weeks of gestation by emergency Caesarean section. The incidence of macrosomia in the polyhydramnios group was 18.8%, while in the control group the incidence was 5.5%. A significant positive relationship was observed between polyhydramnios and birth weight ( $P < 0.003$ ) [Table 2].

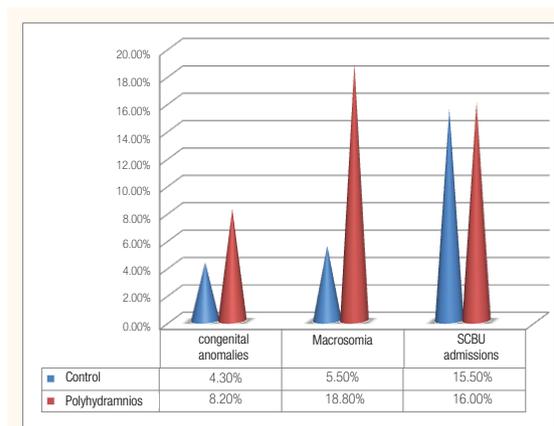
Seventy-six (16.0%) neonates were admitted to the Special Care Baby Unit (SCBU) in the polyhydramnios group, compared to 11 babies (15.5%) from the control group [Figure 4]. Nineteen babies of the 76 in the study group had perinatal asphyxia and 3 had severe birth asphyxia. The latter babies had multiple congenital anomalies and died at the age of 3–4 hours. The other 16 were discharged in good condition.

Seven cases of shoulder dystocia were seen in the study group, while 11 babies in the control group had shoulder dystocia. The average birth weight of the babies who had shoulder dystocia was 3.8–4.0 kg, but none of them had any neurological problem. Eleven babies were admitted with hypoglycaemia, but only for observation.

The perinatal mortality rate in the polyhydramnios group was 42 per 1,000 births as compared to 14 per 1,000 births in the control. The increased perinatal mortality rate in the case of polyhydramnios was due to the underlying cause of



**Figure 3:** Incidence of congenital anomalies in polyhydramnios.  
 CNS = central nervous system; CVS = cardiovascular system.



**Figure 4:** A comparison of neonatal outcomes between the polyhydramnios and control groups.  
 SCBU = special care baby unit.

the polyhydramnios (i.e. congenital anomalies and uncontrolled diabetes).

## Discussion

Recognition of polyhydramnios is of benefit as it allows identification of pregnancies that may be at increased risk of adverse outcomes. Once polyhydramnios is identified, patients need a thorough evaluation as it is associated with an increased frequency of both maternal and fetal complications.<sup>11</sup> Chamberlain cited an increased rate of perinatal morbidity and mortality among patients with hydramnios.<sup>6</sup>

In reviewing the adverse outcomes in pregnancies complicated by polyhydramnios, we found the overall incidence of polyhydramnios to be 1.8% in our population. Of those who were included in our study group, 80% were considered to have mild polyhydramnios, 17.6% of the cases were considered moderate, and 2.4% were considered severe. This is similar to Barnhart’s study, which noted polyhydramnios in 1.7% of 2,730 pregnancies.<sup>12</sup>

A demographic analysis showed that polyhydramnios was more common in older gravida. However, parity had no significant relationship to polyhydramnios. This was consistent with Mariam’s study.<sup>12</sup> However, Biggo *et al.* found a significant relationship between both rising maternal age and parity in polyhydramnios.<sup>13</sup>

The association between diabetes and polyhydramnios is well known.<sup>14</sup> A commonly supported theory is that increased amniotic fluid

volume in diabetic pregnancies could be a result of maternal hyperglycemia which, in turn, produces fetal hyperglycemia and osmotic diuresis. It has consistently been reported that approximately 15% of pregnancies complicated by polyhydramnios occur in diabetic women.<sup>15</sup> This figure was consistent with our study. We found that 73 of our polyhydramnios patients (15.3%) were diabetic, including 59 who were being treated for gestational diabetes or were on a medically supervised diet, Twelve had gestational insulin-treated diabetes. Only two patients had pre-existing diabetes mellitus.

The mean gestational age at delivery was 38.2 ± 1.4 weeks. There was no significant increase in preterm delivery as most preterm deliveries were noticed in case of severe polyhydramnios due to uterine overdistension or fetal anomalies. These comprised only 2.5% of the study group. This result was consistent with Many, whose study showed no increased rate of preterm delivery with polyhydramnios.<sup>16</sup>

The mode of delivery was also influenced by polyhydramnios, with a higher proportion of Caesarean deliveries as compared with those mothers who had a normal volume of amniotic fluid. We found a significantly elevated Caesarean delivery rate in the polyhydramnios group, which had a 24% rate compared to 10.6% in the control group.

In our study, polyhydramnios had an impact on perinatal outcomes, the occurrence of fetal macrosomia and fetal congenital anomalies, and SCBU admissions of neonates. The prevalence of anomalies was 8.1%, which was fairly comparable

with other large series studies. This confirms reports of greater anomaly risks that occur with worsening polyhydramnios.<sup>17</sup> Dashe reported in his study of polyhydramnios and anomaly detection that 11.0% of the neonates in his study had fetal anomalies.<sup>8</sup>

In our study, the high incidence of macrosomia associated with polyhydramnios was consistent with several others studies, and showed a correlation between large-for-gestational-age infants and polyhydramnios.<sup>18</sup>

## Conclusion

The intention of the study was to compare neonatal and maternal outcomes in a control group with women with polyhydramnios. Our findings suggest that once a diagnosis of polyhydramnios is confirmed, a woman should be referred to a perinatal centre with expertise in fetal medicine in order for any anomalies to be detected.

This study demonstrates that the likelihood of an adverse perinatal outcome increases in association with polyhydramnios. There is a significant positive relationship between maternal age, diabetes, and fetal anomalies and macrosomia.

Collectively, data from other studies as well as our own suggests that if polyhydramnios is diagnosed a thorough evaluation for fetal or maternal factors is indicated. At minimum, this should include a comprehensive ultrasound examination and screening for diabetes as it is the most common cause of polyhydramnios. Careful maternal and fetal surveillance during the antepartum, intrapartum and postpartum periods is warranted to anticipate complications due to polyhydramnios.

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