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Pregnancy Outcomes in Term Pregnancy with Isolated Oligohydramnios

Thamon Niamrat, M.D.*,
Sawittri Suwikrom, M.D.*,
Jiraporn Luengmettakul, M.D.*

** Department of Obstetrics and Gynecology, Charoenkrung Pracharak Hospital, Bangkok Metropolitan Administration, Bangkok, Thailand*

ABSTRACT

Objectives: To compare birth asphyxia between term pregnant women with isolated oligohydramnios and normal amniotic fluid (AFI).

Materials and Methods: A retrospective cohort study was conducted in pregnant women who delivered in Charoenkrung Pracharak Hospital from January 1st, 2018, to December 31st, 2020. Obstetrics data and neonatal outcomes were noted among 756 women. Pregnancy outcomes in term pregnancy with isolated oligohydramnios of all 252 pregnant women (study group) were compared to those 504 pregnant women and low-risk pregnancy with normal amniotic fluid index (control group) in 1:2 ratio.

Results: The mean of gestational age of all participants was 38.63 ± 1.03 weeks. The mean AFI were 3.72 ± 1.21 cm and 10.73 ± 2.96 cm in the study and control groups, respectively. Isolated oligohydramnios (study group) was associated with a higher rate in nulliparous (46.4% vs 37.4%, p = 0.014) than in the control group. Moreover, pregnant women with isolated oligohydramnios had a significantly higher incidence of birth asphyxia (4% vs 1.4%, p = 0.024), neonatal intensive care unit admission (5.6% vs 0.4%, p < 0.001), and sick newborn admission (21% vs 13.1%, p = 0.005). There was a higher incidence of primary cesarean section in the study group when compared to the control group (30.6% vs 12.3%, p < 0.001). The justification of the higher rate of cesarean section in the study group was non-reassuring fetal heart rate status (14.7% vs 2.6%, p = 0.001) and failed medical induction (8% vs 1.2%, p = 0.001) when compared to the control group.

Conclusion: Isolated oligohydramnios in term pregnancy significantly increased the risk of birth asphyxia at 1 min and incidence of cesarean section.

Keywords: term pregnancy, isolated oligohydramnios, birth asphyxia, cesarean section.

Correspondence to: *Thamon Niamrat, M.D., Department of Obstetrics and Gynecology, Charoenkrung Pracharak Hospital, Division of Medical service, Bangkok Metropolitan Administration, Bangkok 10120, Thailand. E-mail: thamon.niam@gmail.com*

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ผลลัพธ์การตั้งครรภ์ในสตรีตั้งครรภ์ครบกำหนดที่มีภาวะน้ำคร่ำน้อยอย่างเดียว

ธมน เนียมรัตน์, สาวิตรี สุวิกรม, จิรพร เหลืองเมตตากุล

บทคัดย่อ

วัตถุประสงค์: *เพื่อเปรียบเทียบภาวะการขาดออกซิเจนของทารกแรกเกิดระหว่างสตรีตั้งครรภ์ครบกำหนดที่มีภาวะน้ำคร่ำน้อยอย่างเดียวและสตรีตั้งครรภ์ที่มีน้ำคร่ำปกติ*

วัสดุและวิธีการ: *การศึกษานี้เป็นการศึกษาย้อนหลัง โดยศึกษาในสตรีที่คลอดบุตรที่โรงพยาบาลเจริญกรุงประชารักษ์ในช่วง 1 มกราคม พ.ศ.2561 - 31 ธันวาคม พ.ศ.2563 เป็นจำนวน 756 คน โดยเก็บข้อมูลการตั้งครรภ์ ข้อมูลการคลอด และข้อมูลทารกแรกคลอดของหญิงตั้งครรภ์นั้น และทำการคำนวณและเปรียบเทียบผลของทารกในหญิงตั้งครรภ์ครบกำหนดที่มีภาวะน้ำคร่ำน้อยและหญิงตั้งครรภ์ครบกำหนดที่มีภาวะน้ำคร่ำปกติ โดยแบ่งกลุ่มอัตราส่วน 1:2 การศึกษาในครั้งนี้จะศึกษาในหญิงตั้งครรภ์ครบกำหนดที่มีภาวะน้ำคร่ำน้อยทั้งหมด 252 ราย และมีหญิงตั้งครรภ์ครบกำหนดที่มีภาวะน้ำคร่ำ 504 ราย*

ผลการศึกษา: *สตรีตั้งครรภ์ที่เข้าร่วมงานวิจัยมีอายุครรภ์เฉลี่ยเท่ากับ 38.63 ± 1.03 สัปดาห์ โดยในกลุ่มศึกษามีค่าเฉลี่ยดัชนีน้ำคร่ำ 3.72 ± 1.21 ซม. กลุ่มเปรียบเทียบมีค่าเฉลี่ยดัชนีน้ำคร่ำ 10.73 ± 2.96 ซม. การศึกษานี้พบว่าสตรีตั้งครรภ์แรกพบจำนวนสตรีตั้งครรภ์ที่มีภาวะน้ำคร่ำน้อย มากกว่าสตรีตั้งครรภ์ที่มีน้ำคร่ำปกติ (ร้อยละ 46.4 vs 37.4, p = 0.014) อย่างมีนัยสำคัญทางสถิติ จากการศึกษาผลลัพธ์ของการตั้งครรภ์พบว่า สตรีตั้งครรภ์ที่มีน้ำคร่ำน้อยพบ ภาวะขาดออกซิเจนของทารกแรกเกิด (ร้อยละ 4 vs 1.4, p = 0.024) การนอนหอผู้ป่วยทารกวิกฤต (ร้อยละ 5.6 vs 0.4, p < 0.001) การนอนหออภิบาลทารกป่วย (ร้อยละ 21 vs 13.1, p = 0.005) อัตราการผ่าตัดคลอดครั้งแรก (ร้อยละ 30.6 vs 12.3, p < 0.001) และสาเหตุการผ่าตัดเนื่องจากอัตราการเต้นของหัวใจทารกในครรภ์ผิดปกติ (ร้อยละ 14.7 vs 2.6, p = 0.001) และการชักนำให้เกิดการเจ็บครรภ์ด้วยยาล้มเหลว (ร้อยละ 8 vs 1.2, p = 0.001) มากกว่าสตรีที่ที่มน้ำคร่ำปกติอย่างมีนัยสำคัญทางสถิติ*

สรุป: *มารดาที่ตั้งครรภ์ครบกำหนดที่มีน้ำคร่ำน้อยเปรียบเทียบกับมารดาที่ตั้งครรภ์ครบกำหนดที่มีน้ำคร่ำปกติ มีอัตราการเกิดภาวะขาดออกซิเจนในทารกแรกคลอดที่ 1 นาทีหลังคลอด และเพิ่มอัตราการผ่าตัดคลอดอย่างมีนัยสำคัญทางสถิติ*

คำสำคัญ: *การตั้งครรภ์ครบกำหนด, ภาวะน้ำคร่ำน้อย, ภาวะขาดออกซิเจนทารกแรกคลอด, การผ่าตัดคลอด*

Introduction

Amniotic fluid[1] is important in pregnancy for maintaining balanced fluid, electrolyte and body temperature of the fetus. To help the development of muscle, bone, lungs and avoid compression to the fetus in utero, amniotic fluid is produced about 12 days after fertilization from maternal blood flow through the placenta. Then after 8-11 weeks, the fetus begins to produce urine, which becomes a component of amniotic fluid. Fetal urine is the main component of amniotic fluid after 18 weeks of gestation. If the fetus has a urinary tract disorder such as a congenital kidney, this will reduce the amount of amniotic fluid[2]. Usually, amniotic fluid volume increases gradually to the maximum during 36 weeks of gestation, after that, the amniotic fluid volume decreases after 40 weeks of gestation[3]. Ultrasonography is high-efficacy method to measure the amniotic fluid index (AFI)[4]. When the AFI is < 5 cm or the deep vertical pocket (DVP) is < 2 cm, it is defined as oligohydramnios. When the AFI is > 25 cm or DVP is > 8 cm, it is defined as polyhydramnios[5].

Isolated oligohydramnios (IO)[6] is oligohydramnios without congenital anomaly, fetal growth restriction (FGR)[7], intraamniotic infection and maternal complications [such as pregnancy induce-hypertension (PIH), preeclampsia, diabetes mellitus, abruptio placenta, chronic kidney disease, systemic lupus erythematosus (SLE), and antiphospholipid syndrome (APS)]. These conditions decrease blood supply to multiple organs and kidneys; therefore, the fetus produces less urine and resulting in oligohydramnios. The maternal complications which associated with abnormal blood vessel formation may reduce blood flow and oxygen between the placenta and fetus and result in oligohydramnios. Thus, the isolated oligohydramnios is not directly related to maternal and fetal complication as already mentioned.

Oligohydramnios is a common pregnancy complication, and the incidence is approximately 0.5 - 5% of all pregnancies[8]. The degree of oligohydramnios is proportional to the severity of placental hypoperfusion from the reducing maternal blood flow to the placenta, affect fetal growth restriction. Furthermore, oligohydramnios in the third trimester causes the condition of non-reassuring fetal status from external fetal monitoring due to umbilical cord compression, meconium aspiration syndrome, asphyxia[9], high incidence of Neonatal intensive care unit (NICU) admission[10] and fetal death[11]. Early detection of oligohydramnios can reduce the risk of fetal death or neonatal death[12, 13].

The prevalence of neonatal death is approximately 15-30%[14], and birth asphyxia is the main cause[15]. The prevalence of oligohydramnios which is the main cause of birth asphyxia is 11.5%[16]. From the previous study, isolated oligohydramnios is associated with a higher rate of cesarean section, birth asphyxia[17], and NICU admission. However, from the other studies[18], there was no significant difference in the incidence of birth asphyxia and cesarean section in the pregnant women with isolated oligohydramnios when compared to the normal pregnant women.

The incidence of birth asphyxia in Charoenkrung Pracharak hospital is approximately 5-10%. Consequently, we want to study whether isolated oligohydramnios can potentially impact adverse pregnancy outcomes or not. Therefore, the objectives of this study were to determine the pregnancy outcomes, such as rate of birth asphyxia and cesarean section between pregnant women with isolated oligohydramnios and pregnant women with normal amniotic fluid.

Materials and Methods

We performed a retrospective cohort study after the ethical committee approved the research proposal of the Medical Service Department, Bangkok Metropolitan Administration. The data of pregnant women who delivered in Charoenkrung Pracharak Hospital from January 1st, 2018 to December 31st, 2020 were reviewed from medical

chart records and electronic databases.

In that period, we collected the data from term singleton pregnant women who had the evidence of ultrasonographic assessment of AFI and delivered in Chareonkrung Pracharak Hospital. The study group included the pregnant women who had isolated oligohydramnios from the ultrasonographic report (AFI < 5 cm.). The control group consisted of low-risk term pregnancies with a normal amount of amniotic fluid (AFI 5-25 cm), delivered on the same day as the study case. The exclusion criteria included: (1) premature rupture of membranes, (2) multifetal pregnancy, (3) death fetus in utero/still birth, (4) pregnancy with major fetal malformation, (5) pregnant women with obstetrics complications such as hypertensive disorders, diabetes, an autoimmune disease, (6) fetal growth restriction (defined as a sonographic estimated fetal weight below the 10th percentile according to gestation), (7) polyhydramnios (AFI > 25 cm), and (8) incomplete medical record.

All pregnant women in the study and control groups had sonographic documentation of AFI level 1 week before the delivery and completed all medical records. Data were obtained from the admission chart record. The following demographic and obstetrical variables were recorded: maternal age, gravidity, parity, the number of antenatal care (ANC), prior cesarean deliveries, gestational age at delivery, the interpretation of intrapartum external fetal monitoring in the form of reassuring or non-reassuring fetal heart rate status (normal fetal heart rate 120-160 beats/min), and route of delivery. The following neonatal outcomes were collected: Apgar scores at 1 and 5 min (Apgar score at 1 min less or equal to 7 according to World Health Organization (WHO)[19] and Apgar score at 5 min less than 7 according to American College of Obstetricians and Gynecologists (ACOG)[17], birth weight, perinatal morbidity, and perinatal mortality.

From the previous study by Asnafi[21], the sample size was calculated by the incidence of birth asphyxia in pregnant women with oligohydramnios (5.7%) and pregnant women with normal AFI (1.7%). This study used the ratio of 1:2 for the study group and the control group in the same period, 252 pregnant women from term pregnancy with isolated oligohydramnios group and 504 pregnant women from term pregnancies with normal AFI were required. Data were analyzed by parametric and nonparametric statistics using SPSS version 26 (IBM Corp., Armonk, NY). Descriptive statistics, including means, standard deviations, percentages and numbers, appropriately described various characteristics, as appropriate. Various characteristics were compared between the groups using the chi-squared test, or the Mann-Whitney U test, as appropriate. Results were considered statistically significant if $p < 0.05$.

Results

From January 1st, 2018, to December 31st, 2020, there were 9,818 pregnant women delivered at Charoenkrung Pracharak Hospital. Of these, 756 pregnant women were enrolled. We collected 252 pregnant women with isolated oligohydramnios (study group) and 504 pregnant women with a normal amount of amniotic fluid (control group).

Table 1 provides the maternal demographic data. This study showed the mean gestational age of all participants was 38.63 ± 1.03 weeks. The mean AFI values were 3.72 ± 1.21 cm and 10.73 ± 2.96 cm in the study and control groups, respectively. The mean pre-pregnancy body mass index (BMI) in the study group was higher than the control group (26.18 ± 6 vs 21.37 ± 3.63, $p < 0.001$). Isolated oligohydramnios (study group) had a higher number of nulliparous (46.4% vs 37.4%, $p = 0.014$) than the control group. There was no significant difference in the mean gestational age of pregnant women between groups.

The obstetric outcomes are shown in Table 2. The pregnant women with isolated oligohydramnios had significantly higher incidence of primary cesarean section (30.6% vs 12.3%, $p < 0.001$), repeated cesarean section (25% vs 16.7%,

p < 0.001), primary cesarean section due to non-reassuring fetal heart rate status (14.7 % vs 2.6%, p = 0.001) and failed medical induction (8% vs 1.2%, p = 0.001) when compared to the control group. But the control group had a higher incidence of the cesarean section from cephalopelvic disproportion (CPD) (7.9 % vs 8.5%, p < 0.001) than study group. However, there was no significant difference in postpartum hemorrhage between both groups.

Table 1. Maternal demographic characteristics.

Characteristics	Oligohydramnios (n = 252)	Normal (n = 504)	p value
Age (year)	28.63 ± 6.46	27.47 ± 6.08	0.015
Gestational age (weeks)	38.54 ± 1.14	38.67 ± 0.97	0.120
Amniotic fluid index(cm)	3.72 ± 1.21	10.73 ± 2.96	< 0.001
Pre-pregnancy BMI (kg/m^2)	26.18 ± 6	21.37 ± 3.63	< 0.001
Parity			0.014
Nulliparous	117 (46.4%)	187 (37.1%)	
Multiparous	135 (53.6%)	317 (62.9%)	

Data are presented as mean ± standard deviation or n (%). BMI: body mass index

Table 2. Obstetric outcomes between pregnant women with isolated oligohydramnios and pregnant women with normal amniotic fluid.

	Oligohydramnios (n = 252)	Normal AFI (n = 504)	p value
Route of delivery			< 0.001
Vaginal delivery	112 (44.4)	358 (71)	
Primary Cesarean section	77 (30.6)	62 (12.3)	
Repeat Cesarean section	63 (25.0)	84 (16.7)	
Primary cesarean section from			0.001
CPD	20 (7.9)	43 (8.5)	
Fetal heart rate non-reassuring	37 (14.7)	13 (2.6)	
Failed medical induction	20 (8)	6 (1.2)	
Presentation			0.624
Vertex	239 (94.8)	482 (95.6)	
Breech	13 (5.2)	22 (4.4)	
Postpartum hemorrhage	14 (5.6)	50 (9.9)	0.052

Data are presented as n (%). AFI: amniotic fluid index, CPD: cephalopelvic disproportion

Table 3 shows the neonatal outcomes between groups. The mean birth weights were 2,975.39 ± 397.61 grams and 3,139.30 ± 366.51 grams in the study and control groups, respectively. The incidence of birth asphyxia at 1 min in the study group was significantly higher when compared to the control group (4% vs 1.4%, p = 0.024). Moreover, this study displayed a significantly higher incidence of NICU admission (5.6% vs 0.4%, p < 0.001) and sick newborn admission (21% vs 13.1%, p = 0.005) in the study

group compared to the control group. However, the incidence of asphyxia at 5 min, and meconium-stained amniotic fluid were not significantly difference between both groups.

Table 3. Neonatal outcomes between pregnant women with isolated oligohydramnios and pregnant women with normal amniotic fluid.

	oligohydramnios (n = 252)	Normal AFI (n = 504)	p value
Birth weight (grams)	2,975.39 ± 397.61	3,139.30 ± 366.51	< 0.001
Gender			0.719
Male	127 (50.4)	261 (51.8)	
Female	125 (49.6)	243 (48.2)	
Apgar 1 min (birth asphyxia)			
≤ 7	10 (4)	7 (1.4)	0.024
Apgar 5 min (birth asphyxia)			
< 7	1 (0.4)	1 (0.2)	1.000
Meconium stained			0.044
Mild	19 (7.5)	59 (11.7)	
Moderate	6 (2.4)	4 (0.8)	
Thick	1 (0.4)	0	
NICU admission	14 (5.6)	2 (0.4)	< 0.001
Sick newborn admission	53 (21)	66 (13.1)	0.005

Data are presented as mean ± standard deviation or n (%)
AFI: amniotic fluid index, NICU: Neonatal intensive care unit

Discussion

This study showed a significantly higher incidence of birth asphyxia at 1 min after delivery in pregnant women with isolated oligohydramnios than pregnant women with normal amount of amniotic fluid. This was consistent with the previous study by Asnafi[20] which showed a higher rate of birth asphyxia outcome due to oligohydramnios. Oligohydramnios affected fetus via pressure on the umbilical cord, resulting in fetal hypoxia and probably delivery of a neonate with birth asphyxia. Birth asphyxia was diagnosed on Apgar score at 1 min ≤ 7. The Apgar score at 1 min may represent intrapartum condition, and the 5-min Apgar score may represent the management of neonatal resuscitation. In this study, there was no significant difference of birth asphyxia at 5 min after delivery due to early activated management of neonatal resuscitate team then decreased rate of birth asphyxia at 5 min after delivery. However, AFI can be indicated for fetal well-being in pregnancy to detect fetuses at risk of adverse outcomes. This study showed a significantly high incidence of NICU admission and sick newborn ward admission. The high incidence of NICU and sick newborn ward admission were due to oligohydramnios which resulted in newborn with birth asphyxia and higher rates of intrapartum complication from non-reassuring fetal heart rate status then close monitoring in NICU and sick newborn ward was observed. In contrast, the previous studies by Ashwal[21] and Patel et al[11] showed no significant difference in both groups in the incidence of birth asphyxia and NICU admission, which discussed in this topic that isolated oligohydramnios in term pregnancy might be physiologically decreased in amniotic fluid volume from advanced gestation similar to in a normal pregnancy.

This study showed a significantly higher

incidence of cesarean section in pregnant women with oligohydramnios which was consistent with the study by Nankali[22]. The rate of primary cesarean section due to non-reassuring fetal heart rate status is significantly increased in pregnant women with isolated oligohydramnios because this condition causes umbilical cord compression that results in abnormal intrapartum fetal heart rate monitoring. The high incidence of primary cesarean section due to failed medical induction in this study was because we induced labor due to oligohydramnios status at $36^{0/7}$ - $37^{6/7}$ weeks of gestation[23] when the cervix was unfavorable for delivery. In contrast, the previous studies[24] reported no significant difference in the incidence of cesarean section in pregnant women with isolated oligohydramnios and normal amniotic fluid.

In this study, we found that isolated oligohydramnios in term pregnancy more common in the overweight group of pregnant women, however there was no scientific data to explain this association. In contrast, study by Blitz25 found no association between increased BMI and oligohydramnios.

A limitation of this study was that it was a retrospective, single center study. Strength of our study was that a few studies in Thailand have investigated pregnancy outcomes of isolated oligohydramnios in term pregnancy. This knowledge can be applied to provide close monitoring in antepartum and intrapartum pregnant women who have isolated oligohydramnios.

Conclusion

Isolated oligohydramnios in term pregnancy significantly increased the risk of birth asphyxia at 1 min and incidence of cesarean section.

Potential conflicts of interest

The authors declare no conflicts of interest.

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