

Original Article

Low amniotic fluid index and the materno-fetal out come in 3rd trimester of pregnancy

Monir F¹, Nazneen R², Akhter R³, Begum T⁴, Kayum AKMA⁵, Abedin M⁶, Zabin F⁷

Abstract

Amniotic fluid volume is an indirect indicator of fetal well being. About 8% of pregnant women can have low amniotic fluid, with about 4% being diagnosed with oligohydramnios. Oligohydramnios can cause complications in about 12% of pregnancies that go past 41 wks of gestation. This cross-sectional observational study was carried out in the Department of Obstetrics and Gynaecology, BSMMU, Dhaka from July 2010 to December 2010 on 55 admitted pregnant mother of 28-40 weeks gestational age with low amniotic fluid index (<8cm) with or without medical disorders specially during and after delivery along with its impact on mode of termination of pregnancy & complications of the fetus. Most of the mother (64%) had mild oligohydramnios. Most of them were < 37weeks of gestation and 69.1% of them had to undergo caesarean section as there mode of delivery. The indications were mostly (66%) due to less fetal movement, IUGR, previous C/S, malpresentation etc. The current study showed significantly higher rate (65.5%) of low birth weight resulting from the low AFI. The APGAR score less than 7 in 5 minute was significantly higher in severe oligohydramnios group and majority of the neonate experienced complications like RDS (13%), meconium aspiration (21%) with admission in neonatal ward (54%). Low AFI has poorer prognosis to some extent with maternal as well as fetal outcome. It is responsible for a significantly

higher rate of caesarean section & also associated with low birth rate along with low APGAR score and increase in neonatal complications.

Key words : Oligohydramnios, amniotic fluid index, materno-fetal out come

Introduction

Every fetus is surrounded by a protective covering of amniotic fluid no matter the fetus develops inside the mother as a viviparous species or in an egg.¹ The mechanism of amniotic fluid production and its turnover is a complex one. It is produced soon after the amniotic sac formed at about 12 days after conception. Several factors including fetal swallowing, respiratory tract secretion, fetal micturation as well as transudation from maternal serum across fetal membrane or maternal circulation in the placenta work in combination for the production of normal amount of amniotic fluid. It cushions fetus from physical trauma, moreover allow fetal lung growth and maturity.^{2,3}

Along gestational age normal amniotic fluid volume (AFV) varies being 30 ml at 10 wks and gradually peaking to 1 litre at 36-37 weeks gestation. The volume then starts decreasing with a mean AFV of 800 ml at 40 weeks. If the pregnancy is overdue by two weeks or more, the patient may be at risk for low amniotic fluid level since fluid decreases almost by half around 42 weeks of gestation. About 8% of pregnant women can have low amniotic fluid, with about 4% being diagnosed with oligohydramnios. Oligohydramnios can cause complications in about 12% of pregnancies that go past 41 wks. This oligohydramnios can be diagnosed having any of the following features⁴: amniotic fluid volume less than 500ml even at 32-36 weeks gestation, single deepest pocket (SDP) of less than 2cm or amniotic fluid index (AFI) of less than 5cm or less than the fifth percentile^{1,3}

Amniotic fluid volume is an indirect indicator of fetal well being. There are various ways of assessing AFV. In 1985, Phelan et al described a four quadrant method by ultrasonogram for assessing AFI.⁵ Using that technique, an AFI of 8.1-20 cm is defined as normal; AFI between 5.1-8cm as moderate oligohydramnios and AFI of 5 cm or less as severe oligohydramnios. Since then multiple studies have reported increased perinatal morbidity for

1. *Dr Fahmida Monir, Assistant Health Officer
Dhaka South City Corporation, Dhaka
2. Dr Rumana Nazneen, Associate Professor
Holy Family Red Crescent Medical College, Dhaka
3. Dr Rumana Akhter, Assistant Surgeon, Dhamrai
Health Complex, Manikgonj
4. Dr Tahmina Begum, Registrar, Department
of Gynaecology and Obstetrics, Dhaka Medical
College Hospital, Dhaka
5. Dr AKM Abdul Kayum, Medical Officer
Dhaka South City Corporation, Dhaka
6. Dr Mohshina Abedin, Junior Consultant (Gynae)
Burichong Upazilla Health Complex, Comilla
7. Dr Fahmida Zabin, Associate Professor, Department
of Gynaecology and Obstetrics, BSMMU, Dhaka

*For correspondence

fetus with low amniotic fluid volume. The cause of oligohydramnios are the chromosomal abnormalities, premature rupture of fetal membrane, renal agenesis, urethral obstruction and fetal polycystic kidney, placental insufficiency, post maturity etc.⁵ In 1993, a technical bulletin on Obstetric ultrasonography from American college of Obstetricians and Gynaecologists stated that, amniotic fluid index is more accurate and reproducible in determining the abnormality in amniotic fluid volume than other techniques like subjective method or single largest pocket method.^{2,3}

Thus the amniotic fluid index (AFI), as measured by the four quadrant ultrasonic technique was added to antepartum testing to better identify fetuses at higher risk with poor materno-fetal outcome.¹ Oligohydramnios or decreased amniotic fluid has since been correlated with increased risk of intrauterine growth restriction.^{6,7} Approximately 60% of fetus observed to have this IUGR which is a serious feature of fetal jeopardy indicating that the fetus has already begun centralizing the blood flow to protect the brain and other vital organs.⁸ Therefore it is very useful in differentiating the pathologically growth restricted fetus from the one that is merely constitutionally small.⁸ Other complications like congenital abnormalities, post dated pregnancy,¹⁰ meconium passage,¹¹ abnormal fetal heart rate patterns and lower APGAR scores¹² were also commonly seen in multiple studies having this oligohydramnios. Rutherford et al¹² found an inverse relationship between the AFI and nonreactive nonstress test, FHR decelerations, meconium staining, cesarean section for fetal distress, and low Apgar scores. Grubb and Paul¹³ found no significant increase in intervention for fetal distress (either cesarean or operative vaginal delivery) in the group of gravidae with AFI's 2.0 to 4.9 cm when compared to those with values of 5.0cm or more. Sarno et al¹⁴ found that intrapartum oligohydramnios was associated with an increased risk of cesarean section for fetal distress, an APGAR score less than 7 at 1 minute and abnormal fetal heart rate patterns. In 1991, antepartum diagnosis of oligohydramnios at or beyond 34 weeks of gestation, a study by Casey¹⁵ at Parkland Hospital, Dallas showed the interval from USG to delivery was significantly shorter in women with oligohydramnios. The induction of labour was significantly increased. FHR deceleration during labour were also increased with AFI <5cm. Birth weight were significantly less and incident of meconium aspiration syndrome in infant was significantly higher.^{15,16}

This study was carried out to assess materno-fetal outcome with low amniotic fluid index (AFI) (an antepartum AFI of less than 8 cm) in patients presented at their 28-40 wks

of gestation. To see the gestational age of pregnancy during delivery and its mode of termination having AFI <8 cm & to observe the complications of the fetus at the time and just after delivery were also among the objectives.

Methods

This cross-sectional observational study was carried out in the department of Obstetrics & Gynecology, Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka from July 2010 to December 2010. Fifty five admitted pregnant mother at their 28-40 weeks of gestation having oligohydramnios (low amniotic fluid index, AFI <8 cm) with an intact membrane with or without medical disorders were consecutively included in this study. Pregnant women having normal amniotic fluid volume, pregnancy with premature rupture of membrane (PROM), pregnancy with intra uterine death (IUD), multiple pregnancies & pregnancy with polyhydramnios were excluded from the study.

At study entry baseline demography, past obstetric and medical history was recorded. Previous sonographic report, if available, was also recorded. By transabdominal ultrasonography, AFI was measured using four-quadrant technique by dividing the uterus into four quadrants. The vertical diameter of the largest amniotic fluid pocket in each quadrant was measured with the transducer head held perpendicular to the floor. The measurements were summated in centimeter and the result was recorded as the amniotic fluid index (AFI).⁵

On admission, monitoring of fetus was done by biophysical profile (BPP) including cardiotocography (CTG) and ultrasonography. CTG done for 20 minutes to observe baseline foetal heart rate (FHR), beat to beat variability, acceleration and deceleration. Variable deceleration, late deceleration or prolonged bradycardia indicating fetal distress influenced the management plan. Frequent AFI measurements were done depending on fetal condition. Gestational age at the time of delivery along with the onset of delivery was recorded. Delivery mode either vaginal or cesarean section was also noted. Indication for cesarean section was kept in record along with any complications during the operation. Color of the liquor at the time membrane ruptured was recorded as well as its tentative amount if cesarean section done. The placenta for its size and calcification also was noted. Umbilical cord was observed and recorded during delivery.

Neonate whether still birth or alive was recorded. If alive, the birth weight at the time of delivery with APGAR score

at 1 minute and 5 minute observed and noted. Birth weight less than 2.5 kg was considered as low birth weight. Any congenital abnormality, if present, was recorded. Neonatal complication like respiratory distress syndrome, meconium aspiration or others were also recorded. Any resuscitation required just after delivery was noted. If hospitalization needed whether general bed or neonatal intensive care unit(NICU) was taken under consideration. Finally, if possible, length of hospital staying and the neonatal outcome at discharge was recorded.

Informed written consent was obtained from each patient. The study protocol was approved by the institutional ethical committee. Statistical analysis was obtained by using window based computer software devised with Statistical Packages for Social Science (SPSS).

Results

The mean age of the patients was 23 years ± 3.35 (SD). Majority (74.5%) were multiparous and only 25.5% were nulliparous. Majority (63.64%) of the respondents were in the gestational age group of 34 to <37 weeks on admission. Among the mothers, 64% had mild oligohydramnios and 36% had severe oligohydramnios. (Table-I)

On fetal heart rate tracing by cardiotocography (CTG),

Table-I: Distribution of the patient by amniotic fluid index (n=55)

AFI	Number of Patient	(%)
Mild oligohydramnios (5.1 -8 cm)	35	64
Severe oligohydramnios (<5 cm)	20	36
Total	55	100

36.4% were reactive and 64.6% were non-rective. 72.7% were <37 weeks and 27.3% were >37 weeks of gestational age at the time of delivery. 89.1% had normal and 10.9% had meconium stained liquor at the time of rupture of membrane. 27.3% delivered by normal vaginal delivery, 3.6% by assisted vaginal delivery and majority (69.1%) by Caesarian section. 13.3% mother had spontaneous and 86.7 % (majority) had induced labour. 13% of caesarian section was indicated for fetal distress, 21% for meconium stained liquor and 66% for other conditions (malpresentation, intrauterine growth retardation, less fetal movement, previous C/S). Caesarian sections were associated more with severe oligohydramnios and none of the patients with severe oligohydramnios had normal vaginal delivery. (Table-II)

Table-II: Distribution of the patient by comparison between caesarian sections associated with borderline oligohydramnios and severe oligohydramnios

Category of Oligohydramnios	Category of delivery		Grand Total	p - value
	CS	NVD		
Mild	18	17	35	x ² =11.4 P<0.001
Severe	20	0	20	
Total	38	17	55	

Considering the APGAR score of the new born babies (n=55), 67.3 % & 49.1% babies had APGAR score <7 at 1 minute and 5 minute respectively. APGAR score <7 were significantly higher in severe oligohydramnios group and it was statistically significant. (Table-III & IV)

Table -III: Distribution of the newborn by APGAR score (n=55)

APGAR score	At 1 minute		At 5 minute	
	Number of newborn	(%)	Number of newborn	(%)
0 -4	7	12.7	7	12.7
5 -6	37	67.3	27	49.1
>7	11	20.0	21	38.2
Total	55	100.0	55	100.0

Table-IV : Distribution of the newborn by association of APGAR score <7 with oligohydramnios (n=55)

APGAR score	Category of oligohydramnios			p -value
	Mild	Severe	Total	
<7	17	18	35	$\chi^2 = 15.18$ P<0.01
>7	15	5	20	
Total	32	23	55	

65.5% of the newborn weighted <2.5 kg and 34.5% weighted >2.5kg at birth. (Table-V) Neonatal complication was observed in 62% cases & statistically significant number of babies (54.5 %) had to be admitted in neonatal ward.

Table-V: Distribution of the respondents by Birth weight (Kg) (n=55)

Birth weight(Kg)	Number of newborn (%)
<2.5	36 (65.5)
>2.5	19 (34.5)
Total	55 (100)

Discussion

Assessment of amniotic fluid volume during antenatal period is a vital indicator for determining potential risk during delivery. The objective of the study was to assess the effect of low amniotic fluid index (AFI) on maternofetal outcome, specially the time and mode of termination of pregnancy, complications of the fetus during and after delivery. This was an institution based cross-sectional observational study done on a consecutive sample of 55 admitted pregnant mother at their 28-40 weeks gestational age with low amniotic fluid index (<8cm) with or without medical disorder.

In this study, majority (64%) of the mother had mild oligohydramnios whereas only 36% had severe oligohydramnios. Majority (72.7%) of the mothers had gestational age <37 weeks and only 27.3% had completed >37 weeks of gestation. The mode of delivery was normal vaginal delivery in 29.1% cases, assisted vaginal delivery in 1.8% and caesarean section in 69.1% cases. Caesarian Section was indicated for fetal distress in 13%, meconium stained liquor in 21% and for other conditions (less fetal movement, IUGR, previous C/S, malpresentation) in 66% cases - which is the majority component. Chauhan

et al² found 15.2% caesarean section among 341 oligohydramnios patient. Voxman¹⁷ also found increase rate of caesarean section (14.7%) for fetal distress. Sarno et al¹⁴ also found that severe oligohydramnios was associated with an increased risk of caesarian section for fetal distress and APGAR score < 7 at 1 min and abnormal fetal heart rate pattern. The current study has similarity with those studies.

The study shows that majority (86.7%) of the labour was induced and only 13.3% had spontaneous labour. Higher frequency of caesarean section (20 out of 38) was indicated due to severe oligohydramnios and 18 out of 38 caesarean sections were indicated due to mild oligohydramnios. There was no vaginal delivery in severe oligohydramnios group. Mothers with mild oligohydramnios could have improved and waited further for vaginal delivery but due to the less availability for antepartum and intrapartum fetal well being monitoring and to avoid the adverse perinatal outcome, in most cases, caesarean section was done.

The current study showed significantly higher rate (65.5%) of low birth weight (<2.5kg) baby. In a study done by Magann et al among 79 oligohydramnios patients, low birth weight baby was 10%.¹⁸ Casey also observed that among 147 oligohydramnios patients (35%) had low birth weight baby and found that oligohydramnios may be a reflection of poor intrauterine nutrition to the fetus.¹⁵

The current study shows APGAR score <7 in 5 minute were significantly higher (18 out of 35) in severe oligohydramnios than in mild oligohydramnios (17 out of 35). In a review study done by Shankar¹⁰ reported the association of severe oligohydramnios with APGAR score less than 7 (132/4325 patients). Majority (62%) of the neonates had complications at the time of delivery in this study. Complications were contributed due to respiratory distress syndrome (RDS) (13%), meconium aspiration

(21%) and other conditions. In a study done by Chauhan,² among preterm babies, 9% were the victim of respiratory distress syndrome (RDS). In our study, admission in neonatal care unit were 54.5% which was statistically significant ($P < 0.05$). Neonatal admission in two other studies done by Chauhan² and Shankar¹⁰ found 10% and 7% respectively.

Low amniotic fluid index (AFI) was associated with adverse maternofetal outcome in terms of delivery by caesarean section, low birth weight & admission in neonatal ward due to complications like RDS, meconium aspiration & others in this study. Study sample was small here. Moreover maternofetal outcome were not compared with. Further studies having large sample size with control group having normal amniotic fluid volume are recommended.

References

1. Queenan JT, Thompson W, Whitfield CR, Shahsi SI. Amniotic fluid volume in normal pregnancies. *Am J Obstet Gynecol.* 1972; 114: 34-38.
2. Chauhan SP, Hendrix W, Magann EF and Devoe LD. Perinatal outcome and amniotic and fluid index in the antepartum and intrapartum periods. *Am J Obstet and Gynecol.* 1999; 181: 1473-8.
3. Dutta DC. The placenta and foetal membranes in text book of Obstetrics including Perinatology and contraception. 5th ed. 2001.
4. Crowley P. Non- quantitative estimation of amniotic fluid volume in suspected prolonged pregnancy. *J Perinat Med.* 1980; 8: 249-51.
5. Phelan JP, Smith CV, Broussard P, Small M. Amniotic fluid volume assessment using the four-quadrant technique in the pregnancy at 36-42 weeks gestation. *J Reprod Med.* 1997; 32: 540-2.
6. Manning FA, Hill LM, Platt LD. Qualitative amniotic fluid volume determination by ultrasound: antepartum detection of intrauterine growth retardation. *Am J Obstet Gynecol.* 1981; 139: 254-8.
7. Philipson EH, Sokol RJ, Williams T. Oligohydramnios: clinical association and predictive value for intrauterine growth retardation. *Am J Obstet Gynecol.* 1983; 146:271-6.
8. Buhimschi CS, Weiner CP. Polyhydramnios and oligohydramnios. In: Queenan JT, Spong CY, Lockwood CJ, editors. *Management of high-risk pregnancy: an evidencebased approach.* 5th ed. Malden (MA): Blackwell Publishing Ltd.; 2007. p. 421-31.
9. Boyd RL. Polyhydramnios and oligohydramnios. *Emedicine,* May 19, 2006. Available at: <http://www.emedicine.com/PED/topic854.htm>.
10. Shankar L, Kathryn, Carolin LR, Anderson F, Borjan A. Significance of oligohydramnios complicating pregnancy. *Am J Obstet and Gynecol.* 1991; 164: 1597-1600.
11. Divon MY, Marks AD, Henderson C. Longitudinal measurement of amniotic fluid index in postterm pregnancies and its association with fetal outcome. *Am J Obstet Gynecol.* 1995; 172: 142-6.
12. Rutherford SE, Phelan JP, Smith CV, Jacobs . The four quadrant assessment of amniotic fluid volume: an adjunct to antepartum fetal heart rate testing. *Obstet Gynecol.* 1987; 70: 353-6.
13. Grubb DK, Paul RH. Amniotic fluid index and prolonged antepartum fetal heart rate decelerations. *Obstet and Gynecol.* 1992; 79: 558-60.
14. Sarno AP, Ahn MO, Phelan JP. Intrapartum amniotic fluid volume at term: association of ruptured membranes, oligohydramnios, and increased fetal risk. *J Reprod Med.* 1990; 35: 719-23.
15. Casey BM, McIntire DD, Bloom S, Lucas MJ, Santos R, Twickler DM. Pregnancy outcome after antepartum diagnosis of oligohydramnios at or beyond 34 wks of gestation. *Am J Obstet and Gynecol.* 2000; 182: 909-12.
16. Seeds AE. Current concepts of amniotic fluid dynamics. *Am J Obstet and Gynecol.* 1980; 138: 575.
17. Voxman EG, Tran S and Wing BA. Low amniotic fluid index as a predictor of adverse perinatal outcome. *Journal of Perinatology.* 2002;22:282-5.
18. Magann EF, Kinsella JM, Chauhan SP, Mc_amanra MF, Gehring BW and Morison JC. Does an amniotic fluid index of ≤ 5 necessitate delivery in high risk pregnancies? A case control study. *Am J Obstet Gynaecol.* 1999; 180: 1354-9.