

## Pregnancy Outcome between Oligohydramnios and Borderline Amniotic Fluid Index

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### Abstract

**Introduction:** Oligohydramnios or decreased amniotic fluid volume (AFI<5cm) is associated with adverse maternal & Pregnancy outcome. Amniotic fluid is a very complicated yellowish fluid located between the amniotic sac and the fetus. Oligohydramnios is associated with adverse Pregnancy outcome in the form of meconium staining, intrauterine growth restriction (IUGR), caesarean section for abnormal fetal heart rate tracing, low Apgar score and neonatal intensive care unit (NICU) admission. **Objective:** To evaluate the pregnancy outcome of oligohydramnios and borderline amniotic fluid index. **Methods:** This was a prospective study was carried out at Department of Obstetrics & Gynaecology, Rangpur Medical College & Hospital, Rangpur, Bangladesh from January 2022 to June 2022. Total number of sample size will be taken 100. Among them 50 patient of oligohydramnios and 50 patients with borderline amniotic fluid index will be taken as group-A & group-B respectively. 100 singleton pregnancies beyond 28 weeks of gestation with AFI< 8 cm, delivered within seven days of admission. Patients were divided in two groups, those with AFI ≤ 5 cm and borderline AFI of 5.1 to 8 cm. Pregnancy outcome was studied in the form of onset of labor, mode of delivery, fetal heart rate variations, meconium staining and lower segment caesarean section (LSCS) for fetal distress, Apgar score, birth weight, NICU admission and neonatal mortality. **Results:** Amongst the study group, 50% of cases had oligohydramnios (AFI ≤ 5 cm) as against 50% with marginal or borderline AFI. There was no statistical difference in age, parity and gestational age in both the groups. The mean amniotic fluid index in the first group with AFI ≤ 5 cm was 3.48±1.10 and that of second group with AFI of 5.1 to 8 cm was 6.69±0.75. On comparison of mode of delivery in between both the groups, a statistically significant difference was observed for caesarean section in oligohydramnios with AFI ≤ 5 cm group compared to AFI of 5.1 to 8 cm group. Patients with oligohydramnios with AFI ≤ 5 cm were significantly associated with IUGR and presence of abnormal umbilical artery Doppler velocimetry (p <0.05). Adverse Pregnancy outcome was seen in higher percentage of patients having AFI ≤ 5 cm than with borderline AFI. The difference was statistically significant for overall caesarean delivery rate and LSCS for fetal distress (p <0.05). **Conclusion:** An amniotic fluid index of ≤ 5 cm is commonly associated with intrauterine growth restriction and abnormal umbilical artery Doppler velocimetry studies. Adverse Pregnancy outcome is seen in higher percentage of patients having oligohydramnios than that of borderline AFI. Statistically significant difference for overall caesarean delivery rate as well as LSCS for fetal distress mandates the need for close antepartum and intrapartum monitoring.

**Keywords:** Perinatal outcome, Amniotic fluid index, AFI, Oligohydramnios.

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## INTRODUCTION

Amniotic fluid is a very complicated yellowish fluid located between the amniotic sac and the fetus [1]. Enriched with so many growth factors and nutrients, amniotic fluid plays a key role in fetal growth and is essential for lung maturation [2]. In the first trimester of pregnancy the amniotic fluid is mainly made up of fluid supplied by the transudation of maternal serum across the placental membranes. In the second trimester, fetus becomes the main producer of amniotic fluid. Transudation of fetal plasma through the highly permeable fetal skin before it keratinized at 20 weeks, fetal urine and fluid excreted from fetal lung are the main source of amniotic fluid. Secretion from amniotic epithelium is also another source of amniotic fluid [3]. Amniotic fluid provides a protected environment for the growing fetus. It cushions the fetus against mechanical and biological injury and supplies nutrients for its growth. The normal average volume of amniotic fluid at 16 weeks of gestation is 250ml, it increases to 800ml at 28 weeks and further to 1000ml at 38 weeks and decreases slightly to 800 ml at 40 weeks [4]. Any decrease or increase in the volume of amniotic fluid leads to pregnancy complication [5]. Oligohydramnios is defined as amniotic fluid index less than 5 cm or 10<sup>th</sup> percentile for the gestational age or AFI less than or equal to 5 cm irrespective of gestational age measured by four-quadrant ultrasonic technique described by Phelan [6]. It can be categorized as mild, moderate & severe oligohydramnios when maximum vertical pocket measuring <3, 2 or 1 cm respectively. The incidence of oligohydramnios (<5 cm) is reported about 0.5–5%, depending on the study population, gestational age and the definition of oligohydramnios [7, 8]. Borderline or marginal oligohydramnios has been defined by different cutoffs value by various authors. Phelan *et al.*, and others defined borderline AFI between 5.1 to 8 cm [6]. Gumus *et al.*, Banks and Miller defined as an AFI of 5.1 to 10 cm [9, 10]. Kreiser defined it as AFI >5cm but below the 2.5th percentile which would be AFI between 6 to 9 cm [11]. In majority of cases the causes of oligohydramnios is unknown. Maternal causes are premature rupture of membranes, placental dysfunction, hypertensive disorder and fetal causes are chromosomal or structural anomalies, renal agenesis, fetal polycystic kidney, IUGR, Post maturity. However, in many cases, oligohydramnios is an isolated finding [3]. Oligohydramnios particularly when severe can lead to fetal deformity, umbilical cord compression or even fetal death. Poor fetal outcome in the form of preterm, LBW, low APGAR score, Increase chance of NICU admission, still birth, IUFD are seen with oligohydramnios in comparison to pregnancy with normal amniotic fluid volume [12]. Maternal complication such as prolonged labour due to inertia, tedious vaginal delivery due to dry labour, increased operative interference, traumatic PPH, caesarean section & its complications are more common in oligohydramnios. Thus, evidence of multiple studies

suggest that, oligohydramnios is associated with an increased risk of adverse pregnancy outcome to both mother & fetus [12, 13]. Several studies reported that oligohydramnios has been correlated with an increased risk for caesarean delivery due to non-reassuring FHR, lower Apgar scores and a higher rate of neonatal intensive care unit admission (NICU) [12-14]. On the other hand, it has been suggested that the higher rate of adverse pregnancy outcome in cases of isolated oligohydramnios is the result of the higher rate of medical intervention (labour induction and caesarean section) rather than the result of oligohydramnios by itself such as iatrogenic prematurity & its complication [15, 16]. Oligohydramnios, or decreased amniotic fluid, has since been correlated with increased risk of intrauterine growth Restriction [17, 18]. Congenital abnormalities, postdated pregnancy, meconium passage, abnormal fetal heart rate patterns, and lower Apgar scores is associated with Oligohydramnios in multiple studies [19-22]. Rutherford found an inverse relationship between the AFI and nonreactive non-stress tests, FHR decelerations, meconium staining, caesarean section for fetal distress, and low Apgar scores. Antepartum fetal heart rate decelerations have also been associated with oligohydramnios [22]. So, assessment of amniotic fluid volume during antenatal period is considered a helpful tool in detecting who are at risk for adverse neonatal outcome. The purpose of this study is to compare the outcome in oligohydramnios (AFI  $\leq$  5 cm) with borderline AFI of 5.1 to 8 and to determine the pregnancy outcome with decreasing amniotic fluid volume.

## MATERIALS & METHODS

**Study design:** Prospective study.

**Place of study:** Department of Obstetrics & Gynaecology, Rangpur Medical College & Hospital, Rangpur, Bangladesh.

**Study Duration:** January 2022 to June 2022.

**Sample size:** Sample size will be determined on the basis of the following formula:  $n = z^2 pq / d^2$ . But for the time constraint, total number of sample size will be taken 100. Among them 50 patient of oligohydramnios and 50 patients with borderline amniotic fluid index will be taken as group-A & group-B respectively.

### Inclusion criteria:

1. After 28 weeks of gestation.
2. Amniotic fluid index <8
3. Intact membrane.
4. Singleton pregnancy with cephalic presentation.

### Exclusion criteria:

1. Associated fetal malformation.
2. Associated medical disorder.
3. Postdated pregnancy.

**Study population:** All pregnant lady having AFI<8 cm by USG who will be admitted in antenatal & labour ward during the study period in Rangpur Medical College Hospital, Rangpur, fulfilling the inclusion and exclusion criteria will be assigned for the study. According to WHO, age of viability is 22 weeks with intensive medical care. In Bangladesh, the age of the viability is 28 weeks of gestation. Pregnant lady having oligohydramnios (AFI<5cm by USG) who will be admitted in ante-natal & labour ward in Rangpur Medical College during this study period will be considered as group-A after satisfying inclusion & exclusion criteria. Pregnant lady having borderline AFI 5.1-8 cm by USG and matched for other variable such as age, parity, gestational age, will be taken as group-B group. Ethical clearance will be taken from ethical committee. After proper counselling of patient or her legal guardian who will agree and meet the selection criteria will be taken as sample. Data will be collected in a preformed questionnaire. A detailed history, examination, ultrasound & other investigations will be done. All the findings regarding history, clinical examination, investigation, treatment, mode of delivery, intrapartum complication and fetal outcome of both group-A & group-B will be recorded in data collection sheet. Maternal outcome in the form of onset of labour, mode of delivery, labour related events like abnormal fetal heart rate, meconium staining of liquor and LSCS for fetal distress were studied. Pregnancy Outcome in the form of Apgar score at 1 min and 5 min; Birth weight, NICU admission and neonatal mortality were studied.

#### Operation Definitions:

**Oligohydramnios:** It is a condition in pregnancy characterized by a deficiency of amniotic fluid. Sonographically, it is defined when maximum vertical pocket of liquor is <2 cm or when amniotic fluid index (AFI) is <5 cm (<10<sup>th</sup> percentile).

**Normal amniotic fluid volume:** It is related to gestational age.it measures about 50ml at 12 weeks, 400ml at 20 weeks and reaches its peak of 1000 ml at 36-38 weeks. Thereafter the amount diminishes, till at term it measures about 600-800ml.

**Amniotic fluid index (AFI):** AFI is the score (expressed in cm) given to the amount of amniotic fluid seen on ultrasonography of a pregnant uterus. To determine the AFI, doctor may use a four-quadrant technique, when the deepest, unobstructed, vertical length of each pocket of fluid is measured in each quadrant and then added up to the others or the so called “Single Deepest Pocket” technique.

Values:

AFI 8.1-20 cm is considered normal.

AFI 5.1-8 cm is considered borderline.

AFI <5 cm is considered oligohydramnios.

**Borderline Amniotic Fluid Index:** Borderline amniotic fluid index can be defined as AFI 5.1-8 cm by USG. It is an indicator of decreasing amniotic fluid volume.

**Data analysis:** Data will be analyzed by SPSS version-16. Qualitative data will be analyzed as rate, proportion and percentage. Quantitative data will be analyzed as mean and standard deviation. The Chi-square & Unpaired t-test test will be used. The risk factor will be determined by odd ratio. A probability (p) value of <0.05 will be considered highly significant & p<0.001 will be considered highly significant & p>0.05 taken as non- significant.

## RESULTS

Amongst the study group, 50% of cases had oligohydramnios (AFI  $\leq$  5 cm) as against 50% with marginal or borderline AFI. There was no statistical difference in age, parity and gestational age in both the groups. The mean amniotic fluid index in the first group with AFI  $\leq$  5 cm was  $3.48 \pm 1.10$  and that of second group with AFI of 5.1 to 8 cm was  $6.69 \pm 0.75$  (Table-1). On comparison of mode of delivery in between both the groups, a statistically significant difference was observed for caesarean section in oligohydramnios with AFI  $\leq$  5 cm group compared to AFI of 5.1 to 8 cm group (Table-2). Associated high risk factors were observed in the groups which included pregnancy induced hypertension (31%), intrauterine growth restriction (27%), prolonged pregnancy (11%), abruptio placentae (5%) and severe anemia (4%). In 40% of the cases no obvious high risk factors (isolated oligohydramnios) were observed. Umbilical artery Doppler studies showed that out of the 29% patients with abnormal Doppler, 17% had increased SD ratio, whereas absent diastolic flow and reversal of flow was seen in 7% and 5% cases respectively (Table-3). Outcome parameters in both the groups were analysed. Labor was induced in (38%) patients with oligohydramnios as compared to 18% patients with borderline AFI. More number of patients amongst oligohydramnios required caesarean section as compared to borderline AFI group. The occurrence of nonreassuring FHR pattern in the form of late and variable decelerations was more in oligohydramnios (35.0%) than borderline AFI (27.45%). Meconium stained liquor was found in 31% patients. Fetal distress was the indication for LSCS in 40% of all LSCS. It was significantly higher in oligohydramnios group than borderline AFI group. We observed that 68.0% of oligohydramnios had birth weight less than 2.5 kg, whereas it was 64.0% in the borderline AFI group. Apgar score of <7 at 1 was seen in 26.0% of the babies from oligohydramnios group as against 11.7% from borderline AFI group. 30.0% babies from oligohydramnios group required NICU admission. There were 2 neonatal deaths one due to sepsis and the other due to meconium aspiration (Table-4).

**Table-1: Demographics characteristics of the patients (N=100)**

Variables	AFI <5 (n=50)	AFI 5.1 to 8 (n=50)	p-value
Maternal age (mean±sd)	25.31±5.06	24.49±4.46	0.394
Parity			
Nulliparous	32(64.0%)	31(62.0%)	0.971
Multiparous	18(38.0%)	18(36.0%)	0.972
Gestational age (mean±sd)	37.95 ± 2.29	37.49 ± 2.46	0.336
Amniotic fluid Index (mean±sd)	3.48 ± 1.10	6.69 ± 0.75	

**Table-2: Mode of delivery (N=100)**

Mode of Delivery	AFI ≤5 (n=50)	AFI 5.1 to 8 (n=50)	p-value
Vaginal	10(20.0%)	26(52.0%)	0.017
Instrumental Vaginal	5(10.0%)	4(8.0%)	0.907
Caesarean Section	37(72.0%)	18(36.0%)	0.008

**Table-3: Associated antepartum risk factors (N=100)**

Associated Risk Factors	AFI ≤5 (n=50)	AFI 5.1 to 8 (n=50)	p- value
PIH	18(36.0%)	13(26.0%)	0.612
IUGR	21(42.0%)	6 (12.0%)	0.023
Abruptio placentae	4(8.0%)	1(2.0%)	0.883
Severe anemia	3(6.0%)	1(2.0%)	0.890
Prolonged pregnancy	6(12.0%)	5(10.0%)	0.917
Isolated oligohydramnios (No obvious risk factor)	15(30.6%)	25 (49%)	0.190
UA velocimetry			
Normal	29(58.0%)	42(84.0%)	0.052
Abnormal	22(44.0%)	7(14.0%)	0.049
Increased SD ratio	13 (26.5%)	3(6.0%)	
Absent diastolic flow	6(12.0%)	1(2.0%)	
Reversal of flow	4(8.0%)	1(2.0%)	

**Table-4: Pregnancy outcome in the two groups (N=100)**

Parameter	AFI ≤ 5 (n=50)	AFI 5.1 to 8 (n=50)	p-value
Induction of labor	19 (38.0%)	9(18.0%)	0.226
Non-reassuring FHR	22(44.0%)	13(26.0%)	0.276
Meconium stained liquor	19(38.0%)	12 (24.0%)	0.426
LSCS			
Fetal Distress	18 (36.0%)	5(10.0%)	0.002
Other indication	20 (40.0%)	12(24.0%)	
Birth Weight			
< 2500 gm	34(68.0%)	32(64.0%)	0.854
>2500 gm	16(32.6%)	18(35.2%)	0.855
Apgar score			
<7 at 1 min	14(28.0%)	5(10.0%)	0.296
<7 at 5 min	5(10.0%)	2(4.0%)	0.879
Admission to NICU	15(30.0%)	9(18.0%)	0.532
Neonatal Death	0	2 (3.9%)	

## DISCUSSION

In our study amniotic fluid volume assessment is one of the important of biophysical profile an important tool in antepartum fetal surveillance to predict the pregnancy outcome. Multiple studies are being carried out to compare the Pregnancy outcome of normal AFI with oligohydramnios. In the study group,

50% of cases had oligohydramnios (AFI ≤5 cm) as against 50% with marginal or borderline AFI. There was no statistical difference in age, parity and gestational age in both the groups. The mean amniotic fluid index in the first group with AFI ≤5 cm was 3.48±1.10 and that of second group with AFI of 5.1 to 8 cm was 6.69±0.75. The concept of borderline AFI with

sonographic estimate of amniotic fluid volume of 5.1 to 8 was originally described by Phelan *et al.* and later by different authors [23]. Considering the adverse pregnancy outcome in patients with borderline AFI and with oligohydramnios of AFI  $\leq 5$  cm, there is still uncertainty about whether both the groups should be combined and treated similarly. In this study the pregnancy outcome was compared in these two groups. In the present study both the groups were comparable in terms of age, parity and gestational age. Amongst the associated antepartum risk factors IUGR was more significantly associated with oligohydramnios than borderline AFI ( $p < 0.05$ ). On comparison of mode of delivery in between both the groups, a statistically significant difference was observed for caesarean section in oligohydramnios with AFI  $\leq 5$  cm group compared to AFI of 5.1 to 8 cm group. The umbilical artery doppler velocimetry was abnormal in 44% cases with AFI  $\leq 5$  as compared to 14% cases with borderline AFI and the difference was statistically significant ( $p < 0.05$ ). Magann *et al.*, in their review on borderline or marginal AFI with peripartum outcome concluded that ultrasonography could be considered for evaluating fetal growth which may help in decision making in such cases [24]. In the study by Kwon *et al.*, it was observed that when abnormal Doppler velocimetry was associated with borderline AFI there was 5-fold increase in the incidence of adverse Pregnancy outcome [25]. In the present study, 40% of the cases no obvious high risk factors (isolated oligohydramnios) were observed. Umbilical artery Doppler studies showed that out of the 29% patients with abnormal Doppler, 17% had increased SD ratio, whereas absent diastolic flow and reversal of flow was seen in 7% and 5% cases respectively. Outcome parameters in both the groups were analysed. Labor was induced in (38%) patients with oligohydramnios as compared to 18% patients with borderline AFI. Though percentage of abnormal FHR tracing in the form of late and variable decelerations was more in patients with oligohydramnios, the difference was not found to be statistically significant. Meconium staining of liquor was found in 38% of oligohydramnios and 24% of borderline AFI, but the difference was not statistically significant. Ghike *et al.*, found meconium staining of liquor in 54% of cases with oligohydramnios and 26.9% with borderline AFI and found the difference to be statistically significant [26]. We found that the rate of cesarean delivery was 72% in oligohydramnios with AFI  $\leq 5$  cm group which is double as compared to other group (36%) and was statistically significant ( $p < 0.05$ ). Similar observations are noted by Ghike *et al.*, [26]. Caesarean section for fetal distress was noted in 34.6% cases of oligohydramnios and 11.7% cases of borderline AFI, the difference is statistically significant ( $p < 0.05$ ). Ghike *et al.*, found rate of cesarean section for fetal distress as 29.73% in oligohydramnios as compared to 9.52% in borderline group and found the difference to be statistically significant [26]. We did not find any significant difference with respect to low

birth weight in between the two groups. The number of low birth weight babies in our study is comparable to study by Chandra *et al.*, (61.53%) [27]. There was no statistically significant difference in both the groups with regard to 1 minute Apgar  $< 7$  and 5 minute Apgar  $< 7$ . NICU admission rate was 24% out of which 2 were neonatal deaths (3.9%). Ghike *et al.*, concluded that Apgar  $\leq 7$  at 1 min and NICU admission rate was more in oligohydramnios group than borderline and found the difference to be statistically significant [26]. They had 5.4% mortality in oligohydramnios and 1.59 in borderline group. Dasari *et al.*, had reported 2.9% Pregnancy mortality in oligohydramnios [28]. In the study by Krieser D *et al.*, pregnancy outcome was assessed in 2 groups (AFI  $\leq 5$  with AFI  $> 5$  cm but  $< 2.5^{\text{th}}$  percentile) where they found no statistically significant differences with respect to labor induction for abnormal NST, cesarean section for FHR abnormalities, presence of meconium and Apgar score  $< 7$  at 5 minutes [29]. We observed that 68.0% of oligohydramnios had birth weight less than 2.5 kg, whereas it was 64.0% in the borderline AFI group. Apgar score of  $< 7$  at 1 was seen in 26.0% of the babies from oligohydramnios group as against 11.7% from borderline AFI group. 30.0% babies from oligohydramnios group required NICU admission. There were 2 neonatal deaths one due to sepsis and the other due to meconium aspiration. In the present study, overall caesarean delivery rate and LSCS for fetal distress was significantly higher in oligohydramnios group as compared to borderline AFI group. There is a possibility that awareness of AFI status at the early stages is also likely to influence the caesarean section rate [30]. Since there was no statistically significant difference observed in the Pregnancy outcome in both the groups pertaining to induction of labour, non-reassuring FHR, meconium stained liquor, Apgar score of  $< 7$  at 1 min and 5min. and NICU admissions, it may be concluded that both groups can be managed similarly. This may be because of presence of more number of cases with associated risk factors like IUGR and abnormal umbilical artery Doppler velocimetry studies in that group. However further studies are required to support our findings.

## CONCLUSION

In concluded, an amniotic fluid index of  $\leq 5$  cm is commonly associated with intrauterine growth restriction and abnormal umbilical artery Doppler velocimetry studies. Adverse Pregnancy outcome is seen in higher percentage of patients having oligohydramnios than that of borderline AFI. Statistically significant difference for overall caesarean delivery rate as well as LSCS for fetal distress mandates the need for close antepartum and intrapartum monitoring.

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**Conflict of Interest:** None

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