

A Retrospective Study to Evaluate the Maternal and Fetal Outcome in 100 Cases of Altered Amniotic Fluid Index

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ABSTRACT

Introduction: Successful pregnancy requires the accumulation of adequate amounts of amniotic fluid both to support fetal growth and to allow for maternal physiologic changes. Disruption of the fetomaternal equilibrium regulating the amniotic fluid balance may result in overproduction (polyhydramnios) or underproduction (oligohydramnios) of fluid and may affect the maternal and fetal outcome.

Aims and Objectives:

- To determine the prevalence of Altered AFI at the study centre,
- To study the co-morbid maternal and fetal factors associated with Abnormal AFI,
- To evaluate the impact of altered AFI on the Maternal & fetal outcome.

Material and Methods: A Retrospective observational study was conducted over 2 years. 100 Pregnant women with gestational age between 20 to 42 weeks attending the OPD and admitted at the study centre with abnormal liquor volumes as detected by USG were enrolled in the study and their maternal and fetal outcomes were documented.

Results: In the present study the prevalence of oligohydramnios was found to be 3.39% and that of polyhydramnios was found to be 1.14%.

Conclusion: Abnormal liquor volumes affect the maternal and fetal outcome adversely especially if they develop in the late second or early third trimester and if associated with other antenatal complications (PIH, GDM) hence close surveillance and follow-up are required when altered amniotic fluid volumes are diagnosed early in pregnancy.

Keywords: Amniotic Fluid Index, Oligohydramnios, Polyhydramnios

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INTRODUCTION

Amniotic fluid is the fluid surrounding the *in-utero* fetus and contained by the amnio-chorionic membranes, it protects and cushions the fetus and plays an important role in the development of fetal organs. Thus, successful pregnancy requires the accumulation of adequate amounts of amniotic fluid both to support fetal growth and to allow for maternal physiologic changes. Loss of fetomaternal homeostasis regulating the properly regulated amniotic fluid balance may result in polyhydramnios or oligohydramnios complicating approximately 7% of pregnancies.¹ Oligohydramnios occurs in 0.5 to 5.5% of pregnancies (Boyd 2002)² and has been associated with meconium staining, fetal intolerance to labor resulting in operative intervention, lower Apgar scores, and admission to NICU. Various maternal conditions like Hypertensive disorders of pregnancy (HDP), Prelabour rupture of membranes (PROM), and placental insufficiency are also known to add to the problem. Similarly, polyhydramnios affects 0.4 to 3.5% of all pregnancies (Boyd 2002)² and is associated with major congenital anomalies, prematurity, maternal conditions like DM, preeclampsia, preterm labor, accidental hemorrhage, and postpartum hemorrhage (PPH) leading to profound implications on maternal and perinatal outcome.

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Hence every case needs careful evaluation, parental counseling, and individualized decisions regarding timing and mode of delivery.

Studies have suggested that dramatic changes in the amniotic fluid volume can be a reflection of abnormalities in maternal and fetal status increasing the risk of perinatal mortality and morbidity in pregnancies complicated by abnormal amniotic fluid volumes. This study aims to evaluate the obstetric and perinatal outcomes of pregnancies complicated by abnormal amniotic fluid volume.

AIMS AND OBJECTIVES

1. To determine the prevalence of Altered AFI at the study centre.
2. To study the co-morbid maternal and fetal factors associated with Abnormal AFI.
3. To study the effect of altered AFI on the mode of delivery.

4. To evaluate the impact of altered AFI on the fetal outcome in terms of Birth weight, APGAR score, NICU admission, and Perinatal mortality.

MATERIALS AND METHODS

Study type/design: Retrospective observational study conducted at SMBT IMS & RC over 2 years.

Study population: 100 Pregnant women with gestational age between 20 to 42 weeks admitted at the study centre with abnormal liquor volumes as detected by USG.

Inclusion criteria: Pregnant Women with AFI ≤ 8 cm or ≥ 25 cm, with gestational age between 20 to 42 weeks at the time of diagnosis with a single fetus; irrespective of age and parity with Intact membranes.

Exclusion criteria: Premature rupture of membranes, Intrauterine fetal death, Pregnancy with Ascites or Ovarian cyst.

The indoor case records of the women included in the study were scanned and data recorded concerning a detailed history, clinical examinations & ultrasound examination for evidence of oligohydramnios or polyhydramnios. Routine antenatal blood investigations & other relevant investigations done in high-risk cases as per the institutional protocol were scanned from the records wherever required & the findings were recorded.

In our institution, the AFI was calculated by Four Quadrant method by using linea nigra and umbilicus to divide the abdomen vertically and horizontally respectively. The maximum vertical diameter of AF in each quadrant, without an aggregate of cord or fetal extremities, was measured in centimeters and summed. Routine institutional management protocol was followed for all cases. All babies were attended by neonatologists and outcome measures recorded were mode of delivery, indication for LSCS, NICU admissions, birth

weight, APGAR score at 1-minute and 5 minutes, perinatal morbidity, and perinatal mortality rate.

Statistical analysis: Done using Mean, Standard deviation, and chi-square test to find any statistical association.

OBSERVATIONS AND RESULTS:

The mean age in oligohydramnios group was $26.07 \text{ SD} \pm 3.48$ and that in the polyhydramnios group was $28.15 \text{ SD} \pm 3.1$.

No significant association was found between parity and severity of either oligohydramnios or polyhydramnios. Mean gestational age in oligohydramnios group was $36.54(\text{SD} \pm 2.42)$ and mean gestational age in the polyhydramnios group was $34.58(\text{SD} \pm 3.1)$.

Antenatal complications were present in 59% of cases of oligohydramnios (PIH 21% & IUGR 24% were commonest followed by malpresentation and post-term pregnancies) and 42% cases of polyhydramnios (Congenital anomalies, Gestational Diabetes, PIH, Malpresentation) however no statistical association was found.

The statistical analysis did not show any association between the onset of labor and the severity of oligohydramnios and polyhydramnios. Fetal distress (56%) was the commonest indication for LSCS in the oligohydramnios group and repeat LSCS (33.3%) in polyhydramnios group.

Meconium-stained liquor was the commonest complication in oligohydramnios group and preterm labor was the commonest complication amongst polyhydramnios group. A statistically significant correlation was not found between low Apgar score and the severity of oligohydramnios and polyhydramnios.

Statistically, there was no association between birth weight and severity of either oligohydramnios or polyhydramnios. NICU admission rate was more in group with severe liquor abnormality.

Table 1: Prevalence

Total ANC patients screened =3240				
Type of Abnormal AFI	Total	Prevalence (%)	Number of patients excluded	Final study population
Patients found to have oligohydramnios	110	3.39	20 women-PROM, 3 -IUFD, 4 women - normal repeat scan 9 cases-not available for follow up	74
Patients found to have polyhydramnios	37	1.14	1 woman - ovarian cyst, 3 Women- normal repeat scan 7 cases - not available	26
Total	137	4.22	Total exclusions=37	100

Table 2: Age distribution

Age (years)	Borderline oligo	Severe oligo	Total (n=74)	Mild poly	Moderate poly	Severe poly	Total (n=26)
20-25	36	4	40(54.05%)	3	3	-	6(23.08%)
26-30	19	8	27(36.49%)	11	1	2	14(53.85%)
31-35	3	2	5(6.76%)	4	1	-	5(19.23%)
≥ 36	1	1	2(2.70%)	1	-	-	1(3.84%)
Total	59	15	74	19	5	2	26

(chi square=6.28, $P=0.043$ S) (chi square=1.719, $P=0.423$ NS)

Table 3: Parity and Abnormal liquor

Parity	Borderline oligo	Severe oligo	Total(n=74)	Mild poly	Moderate poly	Severe poly	Total (n=26)
P0	38	6	44(59.45%)	-	1	-	1(3.84%)
P1	18	8	26(35.13%)	7	2	1	10(38.46%)
P2	2	1	3(4.05%)	9	2	1	12(46.15%)
P3	1	-	1(1.35%)	3	-	-	3(11.53%)
Total	59	15	74	19	5	2	26

(chi square =3.027, P=0.220NS) (chi square=5.67, P=0.06NS)

Table 4: Antenatal complications associated with abnormal AFI.

Antenatal complication	Borderline oligo	Severe oligo	Total	Mild poly	Moderate poly	Severe poly	Total
Present	32	12	44(59.46%)	6	3	2	11(42.31%)
Absent	27	3	30(40.54%)	13	2	-	15(57.69%)
Total	59	15	74	19	5	2	26

(chi square=3.293, P=0.07 NS) (chi-square =2.33, P=0.135 NS)

Table 5: Mode of delivery in cases of Abnormal AFI.

Mode of delivery	Borderline oligo	Severe oligo	Total (n=74)	Mild poly	Moderate poly	Severe poly	Total (n=26)
Vaginal delivery	22	7	29(39.19%)	12	4	1	17(65.39%)
Spontaneous	13	3	16(21.62%)	10	4	-	14(53.85%)
Induced	9	4	13(17.57%)	2	-	1	3(11.54%)
LSCS	34	7	41(55.40%)	7	1	1	9(34.61%)
elective	9	1	10(13.51%)	4	-	-	4(15.38%)
emergency	25	6	31(41.89%)	3	1	1	5(19.23%)
Instrumental delivery							
Forceps	3	1	04(5.41%)	-	-	-	-
Total	59	15	74	19	5	2	26

(Chi-square =0.583, P=0.747 NS) (Chi-square=0.155, P=.0.538NS)

Table 6: Intrapartum and post-partum maternal complications observed in the study population.

Complication	No. of oligohydramnios cases	No. of polyhydramnios cases
Malpresentation	5(6.75%)	2(7.69%)
Preterm labour/delivery	6(8.10%)	8(30.76%)
Prolonged labor	8(10.81%)	-
Meconium-stained liquor	29(39.18%)	1(3.84%)
Abruption	1(1.35%)	-
Fetal heart rate (FHR) deceleration	30(40.54%)	3(11.53%)
Postpartum hemorrhage (PPH)	-	1(3.84%)

Table 7: Distribution of the newborns of the study group according to the various perinatal outcome measures.

Outcome measure	Oligohydramnios cases	Polyhydramnios cases
Prematurity (<37 weeks)	6(8.10%)	7+4(set of twins) (36.67%)
Birth weight		
1.5-2.4kg	13(17.57%)	16(53.34%)
2.5-3.4kg	56(75.68%)	10(33.33%)
3.5-4.4kg	5(6.75%)	4(13.33%)
Meconium aspiration	3(4.05%)	1(3.33%)
APGAR ≤ 7 at 1 min	19(25.67%)	9(30.00%)

Outcome measure	Oligohydramnios cases	Polyhydramnios cases
APGAR ≤ 7 at 5 min	13(17.57%)	4(13.33%)
Cord looped around neck	9(12.16%)	2(6.67%)
Admission to NICU	26(35.14%)	9+4(set of twins) (43.33%)
Perinatal death	2(2.70%)	2(6.67%)
Neonatal death	1(1.35%)	-

Table 8: Distribution of birth weight of babies born to mothers in the study group.

Birth weight (kg)	Borderline oligo	Severe oligo	Total (n=74)	Mild poly	Moderate poly	Severe poly	Total (n=30)
1.5- 2.4 kg	9	4	13(17.57%)	10	4	2	16(53.34%)
2.5- 3.4 kg	45	11	56(75.68%)	9	1	-	10(33.33%)
3.5- 4.4 kg	5	-	5(6.75%)	3	1	-	4(13.33%)
Total	59	15	74	22	6	2	30

Table 9: NICU admission in oligohydramnios and polyhydramnios cases.

NICU admission	Borderline oligo	Severe oligo	Total(n=74)	Mild poly	Moderate poly	Severe poly	Total (n=30)
Yes	17	9	26(35.14%)	6	5	2	13(43.33%)
No	42	6	48(64.86%)	16	1	-	17(56.67%)
Total	59	15	74	22	6	2	30

DISCUSSION

In the present study, the prevalence of oligohydramnios was found to be 3.39% and that of polyhydramnios was found to be 1.14%. Our findings for oligohydramnios were similar with Chhabra S, Dargan R,³ Varma TR *et al.*,⁴ Elliot H *et al.*⁵ and for polyhydramnios with S. Vaid *et al.*,⁶ Biggio and colleagues⁷ Hill LM and associates.⁸

Table 10: Summary of outcome measures in the present study:

Outcome measure	Percentage in oligohydramnios group (%)	Percentage in polyhydramnios group (%)
Mode of delivery		
Vaginal	39.19	65.39
LSCS	55.40	34.61
Instrumental	5.41	-
Non-reactive NST	24.32	11.53
FHR deceleration	40.54	11.53
Meconium-stained liquor	38.18	3.85
LSCS for fetal distress	56.10	22.22
Preterm delivery	8.10	30.76
Birth weight < 2.5 kg	17.57	53.34
Apgar score ≤ 7 at 1min	25.67	30.00
Apgar score ≤ 7 at 5min	17.57	13.33
Admission to NICU	35.14	43.33
Perinatal and neonatal deaths	4.05	6.67

In the present study, 54.04% of oligohydramnios were in the age group of 20 to 25 years (statistically significant) with the next majority in 26 to 30 years (36.49%) comparable to results from other studies.⁹⁻¹³ However, in the present study, 53.85% of polyhydramnios cases were in the age group of 26 to 30 years (statistically not significant). The mean maternal age in the present study was 28.15 SD $\pm$ 3.50. The mean maternal age in other studies is as follows Guin G *et al*⁹ 25.39 SD $\pm$ 4.33, Mathew M *et al.*¹⁵ 30.1 SD $\pm$ 5.12, Pri Paz *et al.*¹⁶ 31.6 SD $\pm$ 6.65 (at the time of delivery) and Tashfeen *et al.*¹⁷ 30.1 SD $\pm$ 5.1.

In the present study, the majority of women (59.45%) with oligohydramnios were nulliparous (statistically not significant) and 57.68% of women in the polyhydramnios were multiparous (statistically not significant), this is similar to the study done by Bangal BV¹¹ in which 54% women were nulliparous. There was no statistically significant association between the severity of oligohydramnios/ polyhydramnios^{9,17} and parity which is similar to the studies done.¹⁸⁻²¹

The mean gestational age at the time of diagnosis in the oligohydramnios cases was found to be 36.54 SD $\pm$ 2.42 in our study, The mean gestational age at the time of diagnosis in polyhydramnios cases was 34.58 SD $\pm$ 3.1 weeks.^{11-13,19-22}

The present study states that maximum cases of oligohydramnios and polyhydramnios were detected between 34 to 38 weeks. The cases detected before 34 weeks had associated complications and the perinatal outcome was poor indicating that abnormal liquor volumes presenting in the late second and early third trimester have a poor prognosis.

In the present study, 55% of mothers with abnormal liquor

had associated Antenatal complications (statistically not significant). 32(54.23%) cases of moderate oligohydramnios, and 12(80%) cases of severe oligohydramnios had antenatal complications. However, polyhydramnios was associated with maternal complications in 42.31% cases (11/26). Thus, there was an increased incidence of antenatal complications in the mothers with abnormal liquor in the present study.^{11,22,25}

In the present study, 39% of mothers with oligohydramnios delivered vaginally and 55% required cesarean section for different indications and 5% of mothers needed instrumental delivery (forceps), 65% mothers with polyhydramnios delivered vaginally and 34% required cesarean section the results are comparable with other similar studies (non-significant association).²⁶⁻²⁸ However, the percentage of LSCS for fetal distress was higher in oligohydramnios(56.10%) group as compared to polyhydramnios (22.22%) cases. The finding is consistent with the finding of Guin G *et al.*⁹ Thus oligohydramnios increases the risk for operative intervention for intrapartum fetal distress as compared to polyhydramnios.

In the present study, 24% of patients developed nonreactive NST and 40% of patients developed prolonged FHR decelerations in oligohydramnios group also 11% of patients developed nonreactive NST and prolonged FHR decelerations among the polyhydramnios group (no significant association).

In the present study 61.11% of the non-reactive NST were found in mothers with oligohydramnios and having antenatal complications as against 38.89% in the isolated oligohydramnios cases. In the present study it was observed that the rate for operative delivery increased in cases of oligohydramnios which were associated with Non-reactive NST and non-reassuring fetal heart rate patterns this can be compared with the results of the study by Grubb *et al.*²⁸ which stated that in patients with prolonged FHR decelerations during antepartum testing, the need for operative intervention for fetal distress is increased when oligohydramnios is present and also in our study there was increased occurrence of operative delivery even if the NST was reactive this finding can be correlated to the findings of Rutherford *et al.*³⁴

In the polyhydramnios group 3(11.53%), fetuses had intrauterine fetal heart rate decelerations and of these 1 had thick meconium-stained liquor. All three cases required emergency LSCS. This is consistent with the finding of Mathew *et al.*,¹⁵ in their study they found non-reassuring fetal status in 5.8% of cases and all required sections. The study recorded an overall rate of preterm delivery in polyhydramnios to be 30.76% comparable^{9,35} with previous studies. In the present study, only 1(3.84%) mother had postpartum hemorrhage after vaginal delivery of twin gestation. This is similar to the finding of Guin G *et al.*⁹ where PPH occurred in 4.4% of cases.

In the oligohydramnios group, the labor was mainly complicated by non-reassuring fetal status & prolonged labor due to uterine inertia & meconium-stained liquor (38%) however polyhydramnios group was complicated with

preterm labor 30% and PPH.

The perinatal outcome was studied with regards to birth weight, Apgar score ≤ 7 at 1-min and 5 min, NICU admissions, and perinatal mortality.

In our study in mothers with oligohydramnios, 83%(61/74) of the babies had birth weights greater than or equal to 2.5 kg and in mothers with polyhydramnios 53.34% (16/30) new-borns had birth weight less than 2.5 kg (statistically no significant).^{35,37,38} The finding is contrary to studies citing a significant decrease in birth weight of babies born to mothers with oligohydramnios.^{25,31,36} Our study also points that the presence of antenatal maternal or fetal unfavorable conditions with oligohydramnios increases the risk of adverse perinatal outcomes in terms of low birth weight.

In the present study, the mean birth weight was 2.5 SD $\pm$ 0.81 in polyhydramnios group. The higher rate of low birth weight in the present study can be due to preterm deliveries in polyhydramnios mothers. Pri Paz *et al.*¹⁶ in their study found an association between the severity of polyhydramnios and the frequency of adverse outcomes including prematurity, SGA and stated that the lower mean birth weight in their study was secondary to the lower gestational age and higher prematurity rate that were noted as the AFI increased.

In the study, both the babies born to the 2 cases of severe polyhydramnios had low birth weight. Of the 6 babies born to mothers with moderate polyhydramnios, 4 newborns were low birth weight. Thus, the findings indicate that the severity of polyhydramnios increases the chances of preterm delivery and low birth weight rate.

In our study 3(10%) newborns had birth weight more than 4 kg which is similar to the study by Mathew *et al.*¹⁵ in which 9.6% newborns had birth weight ≥ 4 kg. Of these 2 were born to mothers with gestational diabetes.

25.67% of newborns born to mothers with oligohydramnios in the present study were found to have a 1-min Apgar score ≤ 7 and 17.57% to have 5 min Apgar score ≤ 7 . However, 30% had Apgar score ≤ 7 at 1-min and 13.33% in newborns born to mothers with polyhydramnios.^{35,38} Our study indicates that the occurrence of low Apgar scores at 1 and 5 min is increased in cases with severe antepartum liquor abnormality consistent with other studies.^{25-27,34}

NICU admissions were recorded in 35% of oligohydramnios and 43% in polyhydramnios group, the rate of NICU admission was more in the severe oligohydramnios group consistent with the results of Sriya R²⁵ and Casey *et al.*¹⁹ Baron *et al.*,²⁹ which stated that borderline oligohydramnios is not significantly associated with adverse neonatal outcomes, also the risk of neonatal morbidity in terms of NICU admission increases in babies born to mothers with high-risk pregnancies associated with oligohydramnios as compared to those with isolated oligohydramnios.^{13,18,39,40} The findings of the study indicate that oligohydramnios increases the risk of adverse perinatal outcomes in terms of NICU admission.

In the polyhydramnios group out of 43.33% of newborns requiring NICU admission in mothers with polyhydramnios.

61.54% were admitted for the indication of prematurity, of these 3 babies required prolonged NICU stay which was 25 days for the twins and 18 days for the baby born to mother with severe preeclampsia who developed a respiratory infection.

Perinatal mortality was recorded in 4% of patients in oligohydramnios group and 6.6% in the polyhydramnios group. In the present study, there were 2(2.70%) perinatal deaths and 1(1.35%) neonatal death in the oligohydramnios group. All three neonates had congenital anomalies associated with oligohydramnios. 1 newborn with pleural effusion and ascites was deeply asphyxiated and could not be revived even with ventilator support. A baby with intestinal atresia succumbed to low birth weight. The newborn with hypoplastic left ventricle had respiratory distress at birth and died in NICU due to respiratory failure on the 22nd day. In the present study, there were no perinatal deaths in the isolated oligohydramnios group.

The findings are consistent with those of Jun Zhang *et al.*¹³ who found a perinatal mortality rate (perinatal + neonatal death) of 5.1% in women with oligohydramnios with associated maternal or fetal condition and no perinatal death in cases of isolated oligohydramnios. The perinatal + neonatal mortality was 4.05% in the oligohydramnios group. Compared to Nazlima *et al.*,¹⁰ Casey *et al.*,¹⁹ Guin G *et al.*,⁹ Bangal BV,¹¹ Golan *et al.*,⁴³ Zhang *et al.*¹³ who reported the rate to be 2.4, 6.4, 20, 24, 16 and 5.1%, respectively.

In the present study, there were 2(6.67%) perinatal deaths and both newborns had associated anomalies in the polyhydramnios group. There was no perinatal death in cases with mild polyhydramnios. The percentage of perinatal deaths in the present study can be compared to Stoll *et al.*⁴⁴ 4.3%, Desmedt *et al.*⁴⁵ 4.9%, and Hill LM⁸ 7%. The percentages reported by Tashfeen *et al.*¹⁷, Mathew *et al.*¹⁵ and Guin G⁹ were higher as compared to the present study. Thus anomalies associated with altered amniotic fluid volumes had poor prognosis.

LIMITATIONS

The present study is a retrospective observational study among the patients presenting with abnormal amniotic fluid volumes (oligohydramnios and polyhydramnios) to assess the development of various events during the pregnancy and its outcome. The sample size of polyhydramnios is also less.

RECOMMENDATIONS

We suggest a prospective case-control study with a large sample size which will provide us with a better prediction of the causative, prognostic factors and outcome analysis of the pregnancy in such patients.

CONCLUSION

The Oligohydramnios was found to occur more frequently as compared to polyhydramnios. Abnormal liquor in association

with high-risk pregnancies and fetal anomalies has a poor prognosis, and the risk of operative or instrumental delivery increases.

Abnormal AFI detected in the late second trimester or early third trimester of pregnancy is associated with other antenatal maternal or fetal co-morbid conditions that affect the outcome of pregnancy and have a guarded prognosis. The severity of the abnormal liquor affects both the maternal and fetal outcomes, adversely.

Hence close surveillance and follow-up are required when altered amniotic fluid volumes are diagnosed early in pregnancy and every case with abnormal amniotic fluid volume needs careful evaluation, parental counseling, and individualized decisions regarding timing and mode of delivery to improve the perinatal outcome.

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