

## Low Amniotic Fluid Index at Term as a Predictor of Adverse Perinatal Outcome

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### Abstract

**Aim** To determine whether an antepartum low amniotic fluid index (AFI) is a predictor of adverse perinatal outcome in normal pregnancy and to determine a threshold level of AFI that could predict an adverse outcome.

**Methods** This was a prospective study conducted among 180 pregnant women at 37–40 weeks of gestation with no known obstetric or medical complications with an  $AFI \leq 5$ th percentile. The results were statistically analyzed and compared.

**Results** In the control group, the mean AFI was 10.14 cm and in the study group, it was 4.14 cm. 65 % patients in the study group and 24 % in the control group had a non-reactive non-stress Test. In the control group, 53 % of patients were induced for reasons other than oligohydramnios, while in the study group, 86 % of patients were

induced for oligohydramnios. Among the control group, 33 % had a LSCS, while 67 % delivered vaginally; and in the study group, 34 % delivered vaginally and 66 % had a LSCS. In our study, a 5-min APGAR  $< 7$  was seen in 34 % in the study group and 11 % in the control group. 33 % neonates in the control group and 64 % in the study group had birth weights  $< 2.5$  kg.

**Conclusions** In the presence of oligohydramnios, perinatal morbidity and mortality are high. Determination of AFI is a valuable screening test for predicting fetal distress.

**Keywords** Amniotic fluid index (AFI) · Oligohydramnios · Perinatal · Fetal distress

### Introduction

Phelan defined oligohydramnios as amniotic fluid index (AFI)  $\leq 5$  cm and borderline oligohydramnios as AFI between 5 and 8 cm between 36–42 weeks of gestation [1]. Oligohydramnios occurs in about 1–5 % of pregnancies at term [2]. In pregnancies of more than 40 weeks of gestation, the incidence may be more than 12 % as the amniotic fluid volume declines progressively after 41 weeks of gestation [3]. Women with oligohydramnios are more likely to have abnormal or non-reactive FHR tracings, increased incidence of fetal distress, and thus an increased incidence of caesarean sections [4]. Oligohydramnios is also the leading indication for labor induction. Labor

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induction increases cesarean delivery, particularly for primiparous women with an unripe cervix [5]. Oligohydramnios is associated with a high rate of pregnancy complications and increased perinatal morbidity and mortality. Thus, AFI-assessed antepartum or intrapartum would help to identify women who need increased antepartum surveillance for pregnancy complications [6]. However, some studies show that AFI is a poor predictor of adverse perinatal outcome and isolated oligohydramnios should not be the only parameter for predicting perinatal outcome [7]. Keeping in mind the above knowledge, the present study was carried out to find whether oligohydramnios can be used as a predictor of adverse perinatal outcome in non-complicated pregnancies at term.

## Materials and Methods

This was a prospective study conducted among 180 eligible women recruited from the OPD and Labor ward. The inclusion criteria for the study were pregnancy at 37–42 weeks of gestation with no known obstetric or medical complications. The exclusion criteria were the presence of obstetric or medical complications and an unwillingness to be a part of the study. The women were divided into control and study groups based on AFI. AFI was measured with the four-quadrant technique and those women with AFI < 5th percentile, i.e., AFI of < 5 cm at term as described by Phelan as oligohydramnios or an amniotic fluid volume of < 500 mL at > 37 weeks of gestation, were included in the study group.

Follow-up of patients identified with oligohydramnios was done till they presented in our labor room in active labor (cervical dilation  $\geq 3$  cm and with good uterine contractions at the rate of 3–4  $\text{min}^{-1}$  lasting for at least 45 s) or were admitted to labor room through the OPD for other indications.

On admission NST was done for all the included patients. Those with non-reactive NST and not in active labor also had BPP done. Documentation of obstetric interventions in the form of induction or augmentation of labor with prostaglandins or pitocin and mode of delivery was done. Documentation of neonatal outcomes in the form of birth weight and APGAR score was also done. Admission to the neonatal unit for perinatal morbidities like APGAR  $\leq 7$ , seizures, hypoglycemia, hypothermia, hyperbilirubinemia, hypocalcemia, meconium aspiration, respiratory depression, and perinatal mortality was documented.

The results were recorded and tabulated. They were statistically analyzed using Chi square test. In addition, epidemiological parameters like sensitivity, specificity, positive predictive value, and negative predictive value were used at required observations.

## Results

Out of the 180 women included in the study, 54 % in the control group and 60 % in the study group were primiparas. So, both the groups were comparable. While only 19 % women in the control group were at gestational age > 40 weeks, the study group included 41 % of such women. The mean AFI for the study group was 4.14 cm and for the control group was 10.14 cm. The non-stress test was non-reactive in 65 % of the patients having AFI  $\leq 5$ , while only 24 % of patients having AFI > 5 had a non-reactive NST ( $\chi^2 = 27.497$ ,  $p < 0.0001$ ) (Table 1). Only 33 % of patients in the control group delivered by LSCS, while 66 % of patients in the study group delivered by LSCS ( $\chi^2 = 21.36$ ,  $p \leq 0.001$ ) (Table 2). 86 % patients in the study group were induced, while only 53 % patients in the control group were induced ( $\chi^2 = 19.53$ ,  $p \leq 0.001$ ); among the inductions in the control group, 7 (18 %) underwent a LSCS, while in the study group, 38 (61 %) underwent a LSCS ( $\chi^2 = 17.539$ ,  $p \leq 0.001$ ). In the control group, 7 (24 %) patients underwent LSCS for fetal distress, while in the study group, 32 (53 %) underwent LSCS for fetal distress (Table 3). The determination of AFI  $\leq 5$  cm as a screening test, in predicting fetal distress during labor requiring LSCS, has a sensitivity of 82 %, specificity of 63.3 %, positive predictive value of 51 %, and negative predictive value of 90 %. A better sensitivity (82 %) and a negative predictive value (90 %) make it a good screening test. The 5-min APGAR  $\leq 7$  was seen in

**Table 1** Distribution of NST pattern

NST	Control group		Study group	
	Number	%	Number	%
Reactive	67	76	32	35
Non-reactive	23	24	58	65
Total	90	100	90	100

Using Chi square test:  $\chi^2 = 27.497$ ;  $p < 0.0001$ . *Result significant*

**Table 2** Mode of delivery

Total no. of deliveries ( $n = 180$ )				
Type of delivery	Control group ( $n = 90$ )		Study group ( $n = 90$ )	
	Number	%	Number	%
Vaginal	60	66	30	34
LSCS	29	33	60	66
Forceps	1	1	–	–

Using Chi square test:  $\chi^2 = 21.36$ ;  $p \leq 0.001$ . *Result significant*

**Table 3** Distribution of indications for LSCS

Indication	Control group (n = 29)		Study group (n = 60)	
	Number	%	Number	%
	Fetal distress	7	24	32
IUGR with oligohydramnios	4	11	18	30
PROM with non-progress of labor	4	14	3	5
Incoordinate uterine action	2	7	–	–
CPD	3	10	–	–
Failure of Induction	4	14	3	5
Elective LSCS	5	20	4	7

Using Chi square test:  $\chi^2 = 6.769$ ;  $p \leq 0.05$ . *Result significant*

**Table 4** Distribution of APGAR  $\leq 7$ 

APGAR $\leq 7$	Study group (n = 90)		Control group (n = 90)	
	Number	%	Number	%
1 min	45	50	22	24
5 min	30	34	9	10

Using the Chi square test:  $\chi^2 = 12.857$ ;  $p = 0.0003$ . *Result significant*

34 % in the study group and 10 % in the control group ( $\chi^2 = 12.857$ ,  $p = 0.0003$ ) (Table 4). Thirty three percent patients in the control group and 47 % patients in the study group had babies weighing between 2 and 2.4 kg, while 17 % of women in the study group had babies weighing less than 2 kg and none in the control group had low birth weight babies ( $\chi^2 = 16.218$ ,  $p \leq 0.001$ ). Fourteen percent of babies in the study group had respiratory distress as compared to 6 % in the control group.

Ninety four percent of the neonates in the AFI 2–3 group were admitted to the NICU, while 26 % of those with AFI 3.1–4 were admitted; in the control group, 14 % in the AFI 5.1–8 group and 6 % in the 8.1–14 group required NICU admission (Table 5). The above results show that maximum perinatal morbidity in the form of fetal distress and low APGAR scores was seen in the study group with an AFI of 2–3.

## Discussion

In our study, 41 % of patients in the study group who presented with isolated oligohydramnios were admitted at >40 weeks. In the study by Gumus et al. [8], gestational age at delivery was 37.7 weeks for the study group and 38.3 weeks for the control group ( $p = 0.004$ ). This result, while being statistically significant, correlates with our

**Table 5** Neonatal complications

Neonatal complications	Control group (n = 90)		Study group (n = 90)	
	Number	%	Number	%
	Shifted with mother	80	89	58
Low birth weight	–	–	15	16
Respiratory distress	5	6	13	14
Meconium aspiration	4	1	17	18
NICU admission	9	10	30	33
Stillbirths	1	1	2	3
Neonatal deaths	–	–	1	1

For NICU admissions, applying the Chi square test:  $\chi^2 = 13.475$ ;  $p = 0.0002$ . *Result significant*

study. Sixty five percent patients in the study group and 24 % in the control group had a non-reactive non-stress test ( $\chi^2 = 27.497$ ,  $p < 0.0001$ ). The above result is statistically significant. In the study by Kumar et al. [9], 40 % of patients had non-reactive NSTs, while in the study by Chandra et al. [10], it was 69.23 % and in the study by Sriya et al. [11], it was 41.55 %. These studies show that more than half of the patients with AFI <5 have non-reactive NSTs. While comparing the incidence of delivery by LSCS in the study and control groups (66 vs. 33 %), in the study by Jandial et al. [6], 56 % patients underwent LSCS, while 44 % patients delivered vaginally in the study group, although Gumus et al. [8] had a  $p = 0.096$  (non-significant) for the same. While inductions were significantly higher in the study group ( $p < 0.001$ ), Rainford et al. [12] ( $p < 0.01$ ), Jandial et al. [6], and Gumus et al. [8] had a similar finding. These studies show that oligohydramnios is an independent indication for induction of labor in most institutes. Comparing the incidence of LSCS for inductions in the control and the study groups ( $p < 0.001$ ), the study by Jandial et al. [6] correlates with our study, and the study by Achalabi et al. [13] based on induction of labor in oligohydramnios and its perinatal outcome, had similar outcomes.

The 5-min APGAR score 7 was seen in 34 % in the study group and 10 % in the control group ( $\chi^2 = 12.857$ ,  $p = 0.0003$ ). In the study by Jandial et al. [6], 25 % of patients with AFI 2–3, 11.11 % of patients with AFI >3–4, and 9.09 % of patients with AFI >4–5 had Apgar scores <7 at 5 min which is similar to our study, while in the studies by Rainford et al. [12] and Conway et al. [14], the results though comparable were non-significant.

In terms of neonatal morbidity in the form of low birth weight <2 kg (17 %) and NICU admissions for various indications (30 vs. 9 %), our findings correlate with those

of Voxman et al. [4], Rainford et al. [12], Gumus et al. [8], and Jandial et al. [6].

## Conclusions

An AFI of  $\leq 5$  cm detected after 37 completed weeks of gestation is an indicator of poor perinatal outcome. In the presence of oligohydramnios, the occurrence of non-reactive NST, abnormal FHR tracings during labor, and thick meconium-stained liquor; development of fetal distress; the rate of LSCS; low 5-min APGAR score; low birth weight; and perinatal mortality are high. Determination of AFI can be used as an adjunct to other fetal surveillance methods. It helps to identify those infants at risk of poor perinatal outcome.

Determination of AFI is a valuable screening test for predicting fetal distress in labor requiring cesarean section. It has a sensitivity of 71 %, negative predictive value of 82 %, specificity of 58 %, and positive predictive value of 43 %.

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