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Original Research Article

An Analytical Study to Determine a Threshold Level of AFI That Could Predict an Adverse Outcome

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Conflict of interest: Nil

Abstract:

Aim: The aim of the present study was to determine a threshold level of AFI that could predict an adverse outcome.

Methods: This study was conducted as an observational study on a total of 200 antenatal females presenting with term pregnancy at Department of Obstetrics and Gynecology, the study period of 2 years.

Results: Out of the 200 women, the mean maternal age was 26.04 in Group 1 and 27.83 in Group 2, out of which, 26 (65%) women were nulliparous in Group 1 and 94 (58.75%) in Group 2. Gestational age was ≤37 weeks in 22 (55%) in Group 1 as compared to 56 (35%) in Group 2. Maternal weight gain during pregnancy was ≤10 kg in 14 (35%) in Group 1 as compared to 12 (7.5%) in Group 2. 29 (72.5%) patients were induced in Group 1 as compared to 80 (50%) in Group 2. Obstetric and perinatal outcomes were studied in both the groups. 6 (15%) women in Group 1 and 24 (15%) women in Group 2 had meconium-stained liquor. The difference was not statistically significant (p = 0.840). Cesarean section was performed in 22 (55%) women in Group 1 as compared to 56 (35%) in Group 2 (p = 0.043). Cesarean section for fetal distress was higher in women with oligo- hydramnios (35%) as compared to women with AFI > 5 (40%) (p = 0.047). Birth weight <2.5 kg was found in 23 (57.5%) patients in Group 1 as compared to 32 (20%) in Group 2. In Group 1, the Apgar score at 1 min was<7 in 15 women (37.5%) as compared to 16 (10%) in Group 2 (p = 0.001). An Apgar score <7 at 5 min was noted in 1 (2.5%) woman in Group 1 and 8 (5%) women in Group 2 (p = 0.860). Cord pH < 7.1 was found in 1 (2.5%) woman in Group 1 as compared to 6 (3.75%) in Group 2 and the difference was not statistically significant (p = 0.752).

Conclusion: Amniotic fluid index is an important determinant of adverse maternal and fetal outcome. AFI <5 is associated with adverse maternal outcome in the form of higher operative delivery and adverse fetal outcome i.e. low birth weight, meconium stained liquor, low APGAR score and higher NICU admission.

Keywords: Oligohydramnios, Perinatal outcome, IUGR, APGAR.

Introduction

Importance of amniotic fluid volume as an indicator of fetal status is appreciated all along. [1] Normally during third trimester, around 3% to 8% of pregnant women are with low amniotic fluid at any point of pregnancy. It is normally anticipated as a sign of placental insufficiency.[2] Most severe and frequent complication of pregnancy is Oligohydramnios and the incidence of this is observed to be about 1-5% of total pregnancies.[3] Amniotic fluid has a number of important roles in embryo/fetal development. It cushions that fetus against trauma, has antibacterial property and promotes growth and development of gastrointestinal and musculoskeletal system. [2] It helps to maintain the fetal body temperature and plays a part in homeostasis of fluid, and permits fetal movements. [4,5] Amniotic fluid volume maintains amniotic fluid pressure thereby reducing the loss of lung fluid- an essential component to pulmonary development. It prevents compression of the umbilical cord. [6] Decreased amniotic fluid volume is frequently one of the first clues to an underlying fetal abnormality or maternal disease state. A significant reduction in the amniotic fluid correlates with an increased rate of both perinatal morbidity and mortality. [7]

Phelan et al described amniotic fluid assessment by amniotic fluid index (AFI) through transabdominal sonography using four-quadrant techniques. [8,9] A substantial decrease in AFV (amniotic fluid volume) may indicate underlying placental insufficiency, which has a definite impact on the growing fetus. Phelan and others, Baron and others and Kwon and others defined oligohydramnios as AFI less than or equal to 5 cm. [8-11] Oligohydramnios is caused by pregnancy-induced hypertension (PIH), congenital anomalies like renal agenesis, PROM (premature rupture of membranes), maternal dehydration (fever, vomiting, diarrhoea), drug-induced (NSAIDs), post-term pregnancies (>40 weeks), infections, idiopathic isolated, etc. Many studies have established that oligohydramnios is associated with increased risk of gross congenital anomalies, intrauterine growth restriction, meconium aspiration syndrome, low Apgar scores, fetal distress, NICU admissions, stillbirths and increased incidence of operative interventions.[12-14]

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. [15] 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. [16]

The aim of the present study was 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.

Materials and Methods

This study was conducted as an observational study on a total of 200 antenatal females presenting with term pregnancy at Department of Obstetrics and Gynecology, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India the study period of 2 years. Antenatal Females with term pregnancy (37 to 40 weeks of gestation) with singleton gestation, cephalic presentation, AFI in the range of 0-20 cm and intact membranes were included whereas patients with ruptured membranes, fetal malpresentations and polyhydramnios were excluded from the study.

All the participants fulfilling inclusion criteria were enrolled and written consent was obtained. Detailed history was obtained using the proforma. Any associated complications in present pregnancy were noted. Females were subjected to detailed clinical examination. All the females were subjected to an ultrasound examination to monitor fetal wellbeing. Amniotic fluid index was also assessed using Phelan's technique. [8] Apart from this, some suspected patients were further evaluated for fetal wellbeing by NST and fetal Doppler studies.

Based upon AFI, all the patients were divided into three groups - AFI<5 cm, AFI 5-8 cm and AFI>8 cm. The groups were compared in terms of maternal outcome and Neonatal outcome.

Statistical Analysis

Data was compiled using MsExcel and analysed using IBM SPSS software version 20 (IBM Corp. Illinois Chicago). Categorical data was expressed as frequency and proportions and chi square test was used to assess the difference between proportions of two group. ROC curve was plotted to determine the cut off value of AFI for predicting adverse outcome. P value less than 0.05 was considered statistically significant respect to the distribution of patients over different classes of a characteristic of interest.

Results

Table 1: Maternal demographic and obstetric characteristics

	AFI ≤5 (n = 40)	AFI >5 (n = 160)	*p* value
Maternal age (mean)	26.04	27.83	0.32
Nulliparity	26 (65%)	94 (58.75%)	0.28
Gestational age ≤37 weeks at delivery	22 (55%)	56 (35%)	0.039
Weight gain ≤10 kg	14 (35%)	12 (7.5%)	0.001
Induction of labor	29 (72.5%)	80 (50%)	0.049

Out of the 200 women, the mean maternal age was 26.04 in Group 1 and 27.83 in Group 2, out of which, 26 (65%) women were nulliparous in Group 1 and 94 (58.75%) in Group 2. Gestational age was ≤37 weeks in 22 (55%) in Group 1 as compared to 56 (35%) in Group 2. Maternal weight gain during pregnancy was ≤10 kg in 14 (35%) in Group 1 as compared to 12 (7.5%) in Group 2. 29 (72.5%) patients were induced in Group 1 as compared to 80 (50%) in Group 2. Obstetric and perinatal outcomes were studied in both the groups.

Table 2: Obstetric and perinatal outcome

	AFI≤ (n=40)	AFI>5 (n=160)	P Value
Meconium-stained liquor	6 (15)	24 (15)	0.840
Total cesarean delivery	22 (55)	56 (35)	0.043
Cesarean for non-reassuring fetal status	14 (35)	64 (40)	0.047
Birth weight <2.5 kg	23 (57.5)	32 (20)	0.001
Apgar score			
1 min <7	15 (37.5)	16 (10)	0.001
5 min <7	1 (2.5)	8 (5)	0.860
Cord pH <7.1	1 (2.5)	6 (3.75)	0.752

6 (15%) women in Group 1 and 24 (15%) women in Group 2 had meconium-stained liquor. The difference was not statistically significant (p = 0.840). Cesarean section was performed in 22 (55%) women in Group 1 as compared to 56 (35%) in Group 2 (p = 0.043). Cesarean section for fetal distress was higher in women with oligo-hydramnios (35%) as compared to women with AFI > 5 (40%) (p = 0.047). Birth weight <2.5 kg was found in 23 (57.5%) patients in Group 1 as compared to 32 (20%) in Group 2. In Group 1, the Apgar score at 1 min was<7 in 15 women (37.5%) as compared to 16 (10%) in Group 2 (p = 0.001). An Apgar score <7 at 5 min was noted in 1 (2.5%) woman in Group 1 and 8 (5%) women in Group 2 (p = 0.860). Cord pH < 7.1 was found in 1 (2.5%) woman in Group 1 as compared to 6 (3.75%) in Group 2 and the difference was not statistically significant (p = 0.752).

Table 3: Secondary outcome measures

	AFI≤ (n=40)	AFI>5 (n=160)	P Value
Non-Reactive NST	13 (32.5)	16 (10)	0.007
Admission to NICU	36 (90)	120 (75)	0.024
NICU stay >2 days	14 (35)	40 (25)	0.184

Non-reactive NST was present in a significant number of patients in Group 1 (32.5%) as compared to Group 2 (10%) (p = 0.007). Most of the babies in Group 1, that is 36 (90%), were admitted to the neonatal intensive care unit (NICU). However, in Group 2, 120 (75%) babies were admitted to the NICU. Thus, in Group 1, there was significant correlation to NICU admission. Duration of NICU stay of more than 2 days was found in 14 (35%) in Group 1 and 40 (25%) in Group 2 (p = 0.184). Therefore, the two groups were comparable with regard to the NICU stay.

Discussion

Modern obstetrics is concerned with the health and well- being of both the mother and the unborn child. Recognition of a fetus at risk for death or damage in utero, quantifying the risk, balancing the fetal risk against the risk of neonatal complications from immaturity, and determining the optimal time and mode of intervention are the cornerstones of modern perinatal medicine. [17] Clinical estimation of amniotic fluid volume (AFV) is an important part of fetal assessment as variation in its amount has been related to a variety of pregnancy complications. Amniotic fluid pro- vides a protective milieu for the growing fetus, cushioning it against mechanical and biological injury. [18,19] Quantification of amniotic fluid is an important component of the biophysical profile in ultrasound evaluation of fetal well- being, especially in the third trimester.[20] Antenatal tests use amniotic fluid volume as a fundamental assessment of chronic in utero stress. Ultrasound being a non-invasive test is ideal for application on a large scale and can be used frequently for repeat AFV determination in the case of suspected abnormalities. [19]

Out of the 200 women, the mean maternal age was 26.04 in Group 1 and 27.83 in Group 2, out of which, 26 (65%) women were nulliparous in Group 1 and 94 (58.75%) in Group 2. Gestational age was ≤37 weeks in 22 (55%) in Group 1 as compared to 56 (35%) in Group 2. Maternal weight gain during pregnancy was ≤10 kg in 14 (35%) in Group 1 as compared to 12 (7.5%) in Group 2. 29 (72.5%) patients were induced in Group 1 as compared to 80 (50%) in Group 2. Obstetric and perinatal outcomes were studied in both the groups. 6 (15%) women in Group 1 and 24 (15%) women in Group 2 had meconium-stained liquor. The difference was not statistically significant (p = 0.840). Cesarean section was performed in 22 (55%) women in Group 1 as compared to 56 (35%) in Group 2 (p = 0.043). Cesarean section for fetal distress was higher in women with oligo- hydramnios (35%) as compared to women with AFI > 5 (40%) (p = 0.047). Birth weight <2.5 kg was found in 23 (57.5%) patients in Group 1 as compared to 32 (20%) in Group 2. In Group 1, the Apgar score at 1 min was<7 in 15 women (37.5%) as compared to 16 (10%) in Group 2 (p = 0.001). An Apgar score <7 at 5 min was noted in 1 (2.5%) woman in Group 1 and 8 (5%) women in Group 2 (p = 0.860). Cord

pH < 7.1 was found in 1 (2.5%) woman in Group 1 as compared to 6 (3.75%) in Group 2 and the difference was not statistically significant (p = 0.752). A study conducted by Baron et al [10] showed that meconium- stained amniotic fluid occurred significantly less often in the oligohydramnios group as compared to the normal AFI group. A study by Voxman et al [21] concluded that there was no difference between the groups with regard to meconium-stained liquor, which was comparable to our study. Chauhan et al [22] in their meta-analysis (1999) found that intrapartum AFI B 5 was associated with increased risk of cesarean section for fetal distress (pooled RR = 1.7), which was similar to our study. Rutherford et al [23] found an inverse relationship between amniotic fluid index and cesarean section for fetal distress. Locatelli et al [24] reported that in uncomplicated term pregnancies with oligohydramnios, the presence of an AFI<5 independently increased the risk for a SGA infant. Morris et al [25] found that 60 % of babies were of LBW in the group with AFI<5, indicating that oligohydramnios had an association with growth restriction. A study by Rutherford et al [23] showed that when the AFI was <5 (36 %), pregnancies resulted in infants with intra uterine growth restriction (IUGR). Chauhan et al [22] reported in their meta-analysis that antepartum AFI of B5 cm was associated with a 5-min Apgar score <7 (pooled RR -1.8, 95 % CI 1.1–2.6). A study by Driggers et al [26] reported a 5-min Apgar score <7 in 3.8 % patients in an oligohydramnios group versus 4.6 % in a normal AFI group, and concluded that there was no significant difference. A study by Grubb et al [27] found the 1-min Apgar score<7 in 84 % patients with AFI B 5 as compared to 14 % in the normal AFI group, which was highly significant (p = 0.01). In the same study, the 5-min score<7 was seen in 13 % patients with AFI B 5 versus 5 % in the normal AFI group.

Non-reactive NST was present in a significant number of patients in Group 1 (32.5%) as compared to Group 2 (10%) (p = 0.007). Most of the babies in Group 1, that is 36 (90%), were admitted to the neonatal intensive care unit (NICU). However, in Group 2, 120 (75%) babies were admitted to the NICU. Thus, in Group 1, there was significant correlation to NICU admission. Duration of NICU stay of more than 2 days was found in 14 (35%) in Group 1 and 40 (25%) in Group 2 (p = 0.184). Therefore, the two groups were comparable with regard to the NICU stay. Literature suggest that oligohydramnios is associated with adverse perinatal outcome. Oligohydramnios was significantly associated with low APGAR score at 1 and 5minutes and higher rate of NICU admission (p<0.05). Though the proportions of neonates requiring NICU admission was significantly higher in low AFI group, indication of NICU admission were statistically similar among neonates of three groups (p>0.05). Similar findings were documented by Gandotra et al, where oligohydramnios was significantly associated with low Apgar score at 5 minutes and NICU admission. [28]

Conclusion

Amniotic fluid index is an important determinant of adverse maternal and fetal outcome. AFI <5 is associated with adverse maternal outcome in the form of higher operative delivery and adverse fetal outcome i.e. low birth weight, meconium stained liquor, low APGAR score and higher NICU admission. Intensive intrapartum care along with fetal surveillance may help in minimizing adverse perinatal outcomes.

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