

# Induction of labor and perinatal outcome: The impact of the amniotic fluid index

Haifa A. Alchalabi<sup>a</sup>, Basil R. Obeidat<sup>a,\*</sup>, Mohammed F. Jallad<sup>a</sup>,  
Yousef S. Khader<sup>b</sup>

<sup>a</sup>Department of Obstetrics and Gynecology, Jordan University of Science and Technology, P.O. Box 2954, Irbid 21110, Jordan

<sup>b</sup>Department of Community Medicine and Public Health, Jordan University of Science and Technology, Irbid, Jordan

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## Abstract

**Objective:** The purpose was to determine the impact of the amniotic fluid index on the perinatal outcome of patients admitted for induction of labor at term.

**Study design:** Patients ( $n = 180$ ) included in the study were those admitted for induction of labor at 37–42 weeks' gestation, with unfavorable cervix and intact membranes. The amniotic fluid index (AFI) was determined in all patients using the four-quadrant technique within 24 h of the induction of labor. Patients were divided into two groups based on their AFI: the oligohydramnios group with  $\text{AFI} \leq 5$  cm ( $n = 66$ ) and a normal group with  $\text{AFI} > 5$  cm ( $n = 114$ ). The perinatal outcomes of the two groups were compared.

**Results:** The two groups were similar with regard to maternal age, gestational age, and birth weight. Meconium staining of the amniotic fluid was significantly higher in the group with  $\text{AFI} \leq 5$  cm ( $p = 0.040$ ). The number of cesarean deliveries due to fetal distress was significantly higher even after adjusting for other confounding factors in the group with  $\text{AFI} \leq 5$  cm (adjusted OR 6.52 [95% CI 1.82, 23.2];  $p \leq 0.0001$ ). There was no significant difference between the two groups with regard to Apgar scores or neonatal admission.

**Conclusion:** Induction of labor at term in patients with oligohydramnios is associated with an increased risk of cesarean delivery due to fetal distress.

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**Keywords:** Induction of labor; Amniotic fluid index; Term; Fetal distress

## 1. Introduction

Oligohydramnios or reduced amniotic fluid volume may be associated with various obstetric problems such as fetal anomalies and premature rupture of the membranes. However, oligohydramnios is often due to impaired placental function such as hypertensive disorders, intrauterine growth restriction (IUGR), and post-term pregnancy.

Various methods of assessing amniotic fluid volume by ultrasound scanning and its relation to perinatal outcome were studied [1–4], but the amniotic fluid index (AFI) as described by Phelan et al. in 1987 remains widely used in

obstetric practise. An AFI of  $\leq 5$  cm indicates reduced amniotic fluid volume [1].

Controversy persists regarding the relation between  $\text{AFI} \leq 5$  cm and perinatal outcome. Several studies, including a meta-analysis by Chauhan et al. in 1999, suggested an increased risk of abdominal delivery due to fetal distress or abnormal fetal heart pattern, more babies with lower Apgar scores, and more neonatal admission in patients with  $\text{AFI} \leq 5$  cm [5–7]. Zhang et al., in a controlled study, found that pregnancies with isolated oligohydramnios had perinatal outcomes similar to pregnancies with normal amniotic fluid index [8]. Other studies also found no relation between  $\text{AFI} \leq 5$  cm and adverse perinatal outcome in complicated and uncomplicated pregnancies [9–12], apart from the association with low birth weight found by Locatelli et al. [13]. In patients with oligohydramnios, delivery is often

\* Corresponding author. Tel.: +962 79 5435379; fax: +962 2 7200624.  
E-mail address: [b\\_obeidat@hotmail.com](mailto:b_obeidat@hotmail.com) (B.R. Obeidat).

expedited by induction of labor mainly for associated obstetric problems like hypertension, IUGR, or post-term pregnancy. Vaginal prostaglandin E2 (PGE2) is frequently needed in these patients because of low Bishop score. Our aim was to study the relationship between AFI and perinatal outcome in patients who had completed 37–42 weeks of pregnancy and had induction of labor with vaginal PGE2.

## 2. Material and methods

Of all patients admitted to the Princess Badea Teaching Hospital and the King Abdullah University Hospital for induction of labor, only patients who fulfilled the inclusion criteria were enrolled in the study ( $n = 180$ ). Inclusion criteria included 37–42 weeks' gestation confirmed by early ultrasound examination and intact membranes at time of induction. AFI was assessed by a specialist obstetrician, as described by Phelan et al., on two occasions at least 24 h apart; the last assessment should be within 24 h of the induction of labor. The Bishop score was assessed immediately before the start of the induction process. Indications for delivery included mainly preeclampsia, chronic hypertension, diabetes mellitus, intrauterine growth restriction, and post-term pregnancy. Patients with premature rupture of membranes at term and those with a favorable cervix (Bishop score  $\geq 7$ ) at the start of the induction process were excluded from the study.

All patients should have a reactive 30-min cardiotocogram prior to insertion of the vaginal PGE2. Starting dose was 3 mg (one prostin vaginal tablet) for primigravida and 1.5 mg (half a tablet) for multiparous women repeated after 6 h if there was no response. All patients had continuous fetal heart monitoring once uterine contractions were established. Resident medical staff caring for the patients knew about the result of the amniotic fluid index, but they did not know about enrollment in the study.

Data collected included: maternal age, parity, gestational age, antenatal complications and indication for delivery, and the appearance of amniotic fluid at amniotomy including meconium-stained or not stained seen. The route of delivery and indications for cesarean section were also determined. Fetal distress was diagnosed by the attending obstetrician on the basis of fetal heart abnormality not corrected with simple measures of left lateral position, hydration, and nasal oxygen. Neonatal outcome data collected included birth weight, Apgar score at 1 and 5 min, and admission to neonatal intensive care unit (NICU).

The difference in the characteristics of patients between the two groups, based on AFI, was analyzed using the chi-squared test. Binary logistic regression was used to compare the adverse outcomes between patients with reduced fluid and those with normal fluid. Multivariate analysis was performed using logistic regression to test the difference in the adverse outcome between the two groups after adjusting for age, parity, antenatal complications, color of the fluid,

and birth weight. A separate model was produced for each outcome. All analysis was performed using Statistical Package for Social Sciences (SPSS, Version 11.5). A  $p$ -value of less than 0.05 was considered statistically significant.

## 3. Results

One hundred and eighty patients were enrolled in the study. Patients were divided into two groups based on their AFI. Sixty-six patients (37%) had  $AFI \leq 5$  cm, and 114 patients (63%) had  $AFI > 5$  cm. Table 1 shows the characteristics of patients in the two groups. The two groups were similar with regard to maternal age, gestational age indication of induction, and birth weight. More multiparous women were in the group with  $AFI > 5$  cm ( $p = 0.015$ ). Meconium staining of the amniotic fluid at amniotomy was significantly higher in the group with  $AFI \leq 5$  cm ( $p = 0.040$ ). The majority of the patients in the two groups had no antenatal complications. However, there were significantly more cases of hypertensive disorders in the group with normal AFI ( $p < 0.001$ ).

In the univariate analysis the overall cesarean section rate was significantly higher in the group with  $AFI \leq 5$  cm (OR

Table 1  
The characteristics of patients categorized by amniotic fluid index (AFI)

Variable	n (%)		p-Value
	AFI $\leq 5$ cm ( $n = 66$ )	AFI $> 5$ cm	
Age (years)			
<20	6 (9.1)	19 (16.7)	0.121
20–29	47 (71.2)	64 (56.1)	
30–39	13 (19.7)	31 (27.2)	
Parity			
Primigravida	36 (54.5)	41 (35.9)	0.015
Multiparous	30 (45.5)	73 (64.1)	
Gestational age (weeks)			
37 to >40	15 (23)	41 (36)	0.065
41–42	51 (77)	73 (64)	
Antenatal care			
No complications	60 (90.9)	72 (63.1)	0.001
Hypertensive disorders	6 (9.1)	29 (25.4)	
Diabetes mellitus	0 (0)	2 (1.8)	
Indication for induction			
Post-term	52 (78.8)	76 (66.7)	0.288
Hypertensive disorders	6 (9.1)	21 (18.4)	
IUGR	6 (9.1)	9 (7.9)	
Diabetes mellitus	0 (0)	2 (1.8)	
Others	2 (3)	6 (5.2)	
Color of fluid <sup>a</sup>			
No meconium	44 (73.3)	83 (86.5)	0.040
Meconium-stained	16 (26.7)	13 (13.5)	
Birth weight (g)			
<2500	7 (10.6)	8 (7)	0.401
$\geq 2500$	59 (89.4)	106 (93)	

IUGR: intrauterine growth restriction.

<sup>a</sup> Not recorded for all patients.

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