



The association of amniotic fluid index measurement and pregnancy outcome

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General Note



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ABSTRACT

Objective: identify the efficacy of AFI (amniotic fluid index) in pregnant women as a predictor of pregnancy outcome including mode of delivery and neonatal outcome. **Methods:** a prospective cohort study done from September 2018 to February 2019, the study involved 300 women with a gestational age between (36 – 40 weeks). The AFI was measured by ultrasound (US), and accordingly, the women were divided into three groups: normal (AFI = 5 – 25cm), oligohydramnios (AFI <5cm), and polyhydramnios (AFI >25cm), each group consisting of 100 women. **Results:** The group of oligohydramnios has a significantly higher rate of C/S, induction of labor in comparison to normal and polyhydramnios (p-value <0.05). There's a significant correlation between AFI and fetal weight, small for gestation is more in oligohydramnios and big baby in polyhydramnios. There's a significant difference between AFI and

clinical/visual intrapartum estimation amount of liquor. There is a significant association between CTG and 1st minute Apgar, but not significant with the 5th minute Apgar score. In true groups (AFI is same with visual estimation), there was a significant association between mode of delivery and neonatal outcome regarding admission to NICU, is higher in elective CS and emergency CS after failed induction of labor, the Failure rate of induction of labor due to fetal distress was more in true oligohydramnios group, but statistically not significant. *Conclusions:* Rate of induction of labor and C/S is higher in oligohydramnios comparing to polyhydramnios and normal liquor. In true oligohydramnios failed of induction due to fetal distress is more but statistically not significant. The type of delivery significantly affects neonatal outcomes regarding admission to NICU.

Keywords: amniotic fluid index, gestational age, oligohydramnios, polyhydramnios

1. INTRODUCTION

Amniotic fluid is a complex fluid located between the amniotic sac and the fetus, contained many growth factors and nutrients, it's necessary for fetal growth and lung maturation (Underwood and Sherman, 2006). The main functions of amniotic fluid are to protect the fetus from trauma, preserve even temperature, permits free movement of the fetus, and inhibit adhesion between fetal parts and amniotic sac (Biradar and Shamanewadi, 2016). The amnion and chorion are combined to create a hydrostatic wedge which helps in dilatation of the cervix during labor, it guards against umbilical cord compression (Biradar and Shamanewadi, 2016). The volume of amniotic fluid change with the gestation, equal to 200ml at 16 weeks, 1000ml at 28 weeks, 900ml at 36 weeks, and 800ml at 40 weeks of gestation (Bhagat and Chawla, 2014). Clinical evaluation of amniotic fluid volume (AFV) has a serious role in predicting fetal well-being as AFV abnormalities are often related to the fetal anomaly, morbidity, and mortality (Adebayo *et al.*, 2017). Amniotic fluid index (AFI) is one of the most common methods for AFV measurement and it's a part of (BPP) biophysical profile, it's a semi-quantitative estimation, first was described by Phelan *et al.*, and it depends on dividing the maternal abdomen to four quadrants and measures deepest pocket SVDP in each quadrant, the sum of these (SVDP) is equal to (AFI) (Peixoto *et al.*, 2016). The normal range of AFI that is mostly used is (5 to 24 cm), with amounts below and above this indicating oligohydramnios and polyhydramnios respectively (Tripathi *et al.*, 2019). The incidence of polyhydramnios regardless of the causes in various studies ranges from 0.2 to 3.9%, nearly 50-60% of cases are with unknown etiology (Bhagat and Chawla, 2014). The amniotic fluid index (AFI) of ≥ 24 cm or ≥ 25 cm defines as "polyhydramnios" which respectively is ≥ 95 , and $\geq 97.5\%$ in normal singleton pregnancies. Poly hydramnios when present without causes e.g. (maternal disease, and fetal anomaly) called " Idiopathic hydramnios" significantly have been associated with higher rates of malpresentation, macrosomia, cesarean delivery, and perinatal mortality. In the literature incidence of oligohydramnios varies from less than 0.5% to above 5%, according to the study population and determination of oligohydramnios (Zhang *et al.*, 2004). Oligohydramnios defines as (AFI) of less than 5 cm or less than the fifth percentile (Gaikwad *et al.*, 2016). Facial and skeletal deformities, pulmonary hypoplasia, even fetal demise can happen as consequences of chronic oligohydramnios. The oligohydramnios associated with an increase in induction of labor, non-reassuring fetal heart rate pattern, meconium aspiration syndrome, and stillbirth. During labor in oligohydramnios umbilical cord compression is common, which increases the risk of cesarean delivery due to fetal distress and may leading to 5-minute Apgar of <7 . However, different race and environment may effect on AFI values, so estimation of normal values in different population may be considered important. The goal of this study is to know the role of amniotic fluid index changes either increase or decrease in adverse perinatal outcome and rate of obstetric intervention like early induction of labor or caesarian section. Also comparing AFI measurement with actual amniotic fluid volume during operation or vaginal delivery.

2. PATIENTS AND METHODS

Study design and setting

A prospective cohort study was performed from September 2018 to February 2019, in the department of obstetrics and gynecology unit, Maternity teaching hospital, Erbil, Iraq. The study involved 300 pregnant women, their gestational age between (36-40) week, amniotic fluid volume evaluated by measuring AFI (amniotic fluid index) with ultrasound by a radiologist, using the technique mentioned by (Phelan *et al.*, 1987). They classified into 3 groups, those with AFI (5-25) termed "adequate", those AFI <5 cm termed "oligohydramnios", and those AFI >25 cm termed "polyhydramnios".

Inclusion criteria

Singleton pregnancy, membrane intact, gestational age between (36-40) weeks.

Exclusion criteria

Multiple gestation, rupture membrane, fetal anomaly, diabetes, and hypertension.

Participants

After obtaining written informed permission from the patient, full history was taken related to (age, parity, gestational age, past medical, surgical, and obstetric history, and fetal movement). Then examination was done including abdominal examination for (fundal height and assessing fetal size), pelvic examination for bishop score (cervical dilatation, effacement, and station) and for excluding rupture membrane or leaking liquor. After that send for routine investigations like (CBC, virology, blood sugar) and CTG (the type of machine is GIMA) was done for indicated cases including (oligohydramnios, polyhydramnios, and those complaining from decreased fetal movement or developing distress during follow up by intermittent auscultation, and during induction of labor).The patients were monitored in labor room regarding (color of the liquor, amount of liquor clinically, and mode of delivery), then after delivery follow upped the fetal outcome regarding (Apgar score, fetal weight, admitted to NCU or not), and those admitted follow upped until seen by neonatologist then discharged.

Statistical analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS, version 22). The Chi-square test of association was used to compare proportions. Fisher's exact test was used when the expected count of more than 20% of the cells of the table was less than 5. McNemar-Bowker test was used when the AFI categories were compared with the number of liquor categories classified clinically (of the same patients). A p-value of ≤ 0.05 was considered statistically significant.

3. RESULTS

Three hundred pregnant women participated in the study. According to the amount of the amniotic fluid, as assessed by the amniotic fluid index (AFI), 100 women were taken from each of the three categories of the amniotic fluid (oligohydramnios, normal liquor, and polyhydramnios) (figure 1). The majority of the women (34.3%) their age was between (20-24) years, but the differences between the three groups were not significant (p-value = 0.089) regarding the age distribution, as presented in Table 1. No significant difference in the gestational age distribution was detected between the three groups (p = 0.693). Table 1 shows that out of 300 women 89 of them (29.7%) were primiparous, the majority of oligohydramnios were primiparous (42%). The majority (72%) of the polyhydramnios group were multi-parous compared with 55% of the oligohydramnios group (p-value = 0.005).

Table 1 Basic characteristics of the three study groups

	Oligohydramnios	Normal liquor	Polyhydramnios	p-value
Age (years)				
<20	12 (12.0)	14 (14.0)	5 (5.0)	0.089
20-24	37 (37.0)	37 (37.0)	29 (29.0)	
25-29	24 (24.0)	14 (14.0)	22 (22.0)	
30-34	19 (19.0)	22 (22.0)	25 (25.0)	
≥ 35	8 (8.0)	13 (13.0)	19 (19.0)	
Gestational age (weeks)				
36	16 (16.0)	12 (12.0)	13 (13.0)	0.693
37-40	84 (84.0)	88 (88.0)	87 (87.0)	
Parity				
Primiparous	42 (42.0)	25 (25.0)	22 (22.0)	0.005
Multiparous	55 (55.0)	64 (64.0)	72 (72.0)	
Grand-multiparous	3 (3.0)	11 (11.0)	6 (6.0)	
Mode of delivery				
Vaginal delivery	57 (57.0)	17 (17.0)	53 (53.0)	<0.001
Vaginal with induction	4 (4.0)	9 (9.0)	3 (3.0)	
Cesarean section	38 (38.0)	61 (61.0)	43 (43.0)	
Induction failed	1 (1.0)	13 (13.0)	1 (1.0)	
1-minute APGAR (<7)	8 (8.0)	27 (27.0)	16 (16.0)	0.002
5-minutes APGAR (<7)	1 (1.0)	3 (3.0)	3 (3.0)	0.706
NICU admission	16 (16.0)	29 (29.0)	18 (18.0)	0.074
Meconium	13 (13.0)	14 (14.0)	7 (7.0)	0.240

Table 2 shows that more than half (52.9%) of those with pathological CTG results had low APGAR score in the first minute, compared with 15.2% among those who need reassurance according to the CTG (p -value < 0.001). No significant association was detected between CTG results and the APGAR score assessed five minutes after delivery (p -value = 0.081).

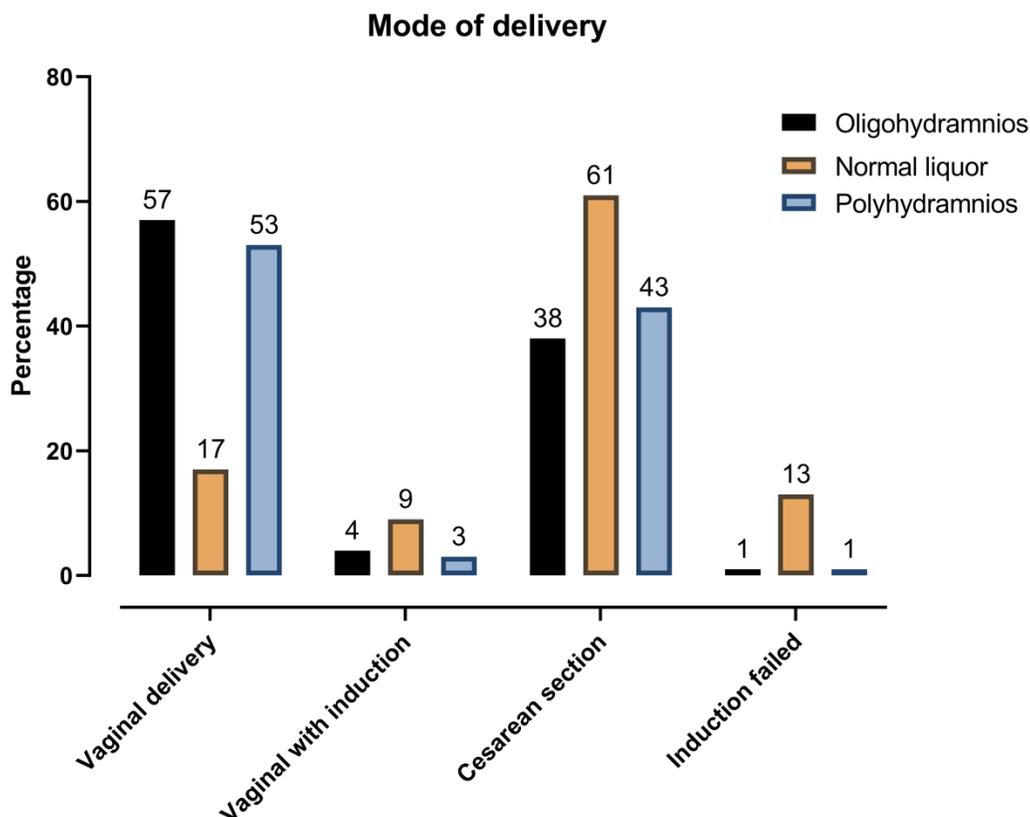


Figure 1 association between mode of delivery with amniotic fluid

Table 2 APGAR scores by CTG results

	Reassurance	Non-reassurance	Pathological	Not done	p-value
Number	138	32	17	113	-
1-minute APGAR (<7)	21 (15.2)	13 (40.6)	9 (52.9)	8 (7.1)	<0.001
5-minutes APGAR (<7)	3 (2.2)	3 (9.4)	0 (0.0)	1 (0.9)	0.081

Table 3 shows that there was significant disagreement between the AFI categories and the clinical categories of the amount of liquor (p -value < 0.001). More than half (57%) of those categorized by the AFI as polyhydramnios, they were considered as normal clinically. More than one third (37%) of those categorized as oligohydramnios by the AFI, they were categorized as normal clinically.

Table 3 Amount of liquor as detected clinically and by AFI

Amount of liquor by AFI	Amount of liquor clinically			p-value
	Normal liquor	Oligohydramnios	Polyhydramnios	
Normal liquor	86 (86)	7 (7)	7 (7)	<0.001
Oligohydramnios	37 (37)	63 (63)	0 (0)	
Polyhydramnios	57 (57)	0 (0)	43 (43)	

4. DISCUSSION

To avoid adverse pregnancy outcomes in both low- and high-risk pregnancies, it's important to estimate amniotic fluid volume, which calculates with ultrasound by measuring (AFI) by an experienced radiologist. Our study compares oligohydramnios, polyhydramnios with normal liquor in the adverse perinatal outcome, while the others used isolated oligohydramnios or

polyhydramnios. Regarding the age and gestational age the difference between the three groups not significant statistically, but isolated oligohydramnios can be seen with increasing gestational age from (37-40) week this can be explained that reduction in amniotic fluid occurs physiologically with advanced gestational age, even in pregnancies with normal amniotic fluid volume. In their study Chetani M et al observed that 63% of women with oligohydramnios were primigravida, while we observed 42% of the women were primigravida in oligohydramnios group which is comparable (Chetani *et al.*, 2017). Regarding mode of delivery, our study reveals that rate of CS is higher in oligohydramnios, which is 61% when compared with normal liquor and polyhydramnios, were 38%, 43% respectively and statistically is significant (p -value < 0.001), which is similar to previous studies (Minwuye *et al.*, 2019, Stein *et al.*, 2012, Wullstein *et al.*, 2001). Incidence of CS increased most commonly because of fetal distress either due to oligohydramnios by itself or due to more induction of labor end with emergency CS because of non-reassurance CTG or failed induction, which is a higher rate in oligohydramnios (13%) and statistically was significant. In the presented study show that low birth weight is higher in oligohydramnios compared to normal and polyhydramnios and statistically significant, which correspond to previous studies (Chidanandaiah *et al.*, 2017, Kapoor *et al.*, 2018), in contrast to other studies done found that low birth weight is higher in oligohydramnios, but statistically not significant (Tripathi *et al.*, 2019, Sultana *et al.*, 2008). However, Patel et al discovered the incidence of low birth weight not higher in isolated oligohydramnios (Patel *et al.*, 2015).

In our study, there is a higher rate of low APGAR score at 1st min in oligohydramnios in comparing to polyhydramnios and normal liquor group which is 27% in oligohydramnios and statistically significant, but in 5 min there is no significant difference between the groups because most of them will improve after 5 min, another study found same result (Kapoor *et al.*, 2018), in contrast to other studies show that there is no significant difference between the groups regarding low APGAR in 1st and 5th min (Rathod and Samal, 2017). Rate of admission to NICU is higher in oligohydramnios compared to normal and polyhydramnios which is (29%), but the difference was not significant statistically similar to the study of (Kapoor *et al.*, 2018), in contrast to other studies the difference was highly significant (Gaikwad *et al.*, 2016, Chetani *et al.*, 2017, Karim *et al.*, 2010). Concerning polyhydramnios, there is no significant adverse perinatal outcome including (admission to NICU and low APGAR score), like in the previous study (Aviram *et al.*, 2015), in contrast to Aviram et al that showed an isolated polyhydramnios increase rate of shoulder dystocia, low APGAR, and higher admission to NICU, this discrepancy because there's a difference in the type of study, sample size, and exclusion criteria, our study did not include preterm, congenital anomaly, DM or hypertension.

5. CONCLUSION

The rate of induction of labor and caesarian section increased in oligohydramnios and polyhydramnios in comparison to normal liquor, however, there's no significant difference in neonatal outcome regarding (APGAR SCORE and NICU admission) between the groups, but among true groups, the mode of delivery significantly affected on NICU admission.

Author contribution

Avesta Anis Shaker: Conception and design of the work, the acquisition, analysis, and interpretation of data for the work, and Drafting the work.

Srwa Ismael Khalid: Conception and design of the work, interpretation of data for the work, and revising it critically for important intellectual content

Hayder A Fawzi: Conception and design of the work, and Drafting the work and finally revising it critically for important intellectual content

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Conflict of Interest

The authors declare that they have no conflict of interest.

Informed consent

Written informed consent was obtained from all individual participants included in the study. Additional informed consent was obtained from all individual participants for whom identifying information is included in this manuscript.

Ethical approval for human

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards (Code: 2019/C081).

Peer-review

External peer-review was done through double-blind method.

Data and materials availability

All data associated with this study are present in the paper.

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