Correlation of reduced amniotic fluid index with maternal outcome

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Abstract
Background: Amniotic fluid volume estimation is an important part of fetal assessment as variation in its amount has been related to a variety of pregnancy complications. Our aim was to determine whether low amniotic fluid index (AFI) affects maternal and fetal outcome.
Methods: This prospective observational study included 200 antenatal patients of term gestation of which 100 cases with AFI<8 and 100 controls with AFI ≥8 but ≤ 15 were included in study. Ultrasonography and NST were done and results of both groups compared for the presence of meconium passage, non reactive NST, abnormal fetal heart rate, induction of labour, mode of delivery.
Results: There was increased incidence of non-reactive NST (40% vs 12%), meconium stained (33% vs 10%) in oligohydramnios group. 49 out of 100 patients (49%) had vaginal delivery out of which 32 (64.6%) were spontaneous in onset and 17 (35.4%) were induced. While in controls 78% had vaginal delivery out of which 91% were spontaneous while 9% were induced. 51% underwent LSCS out of which 18% underwent elective and 33% had emergency LSCS in cases while in controls 22% underwent LSCS all of them were emergency cesarean.
Conclusion: Oligohydramnios affect the maternal outcome in terms of obstetrical interventions like LSCS for fetal distress, meconium stained liquor and non reassuring fetal heart rate. Vaginal delivery and caesarean section should be well balanced so that unnecessary maternal morbidities are prevented and labour outcome improved.

Keywords: Oligohydramnios, Labour induction, Cesarean delivery, Maternal outcome

Introduction

Modern obstetrics is concerned with the health and wellbeing of both the mother and the unborn child. Amniotic fluid volume is a variable that has got great impact on the fetal condition in the intrapartum period. Clinical estimation of amniotic fluid volume is an important part of fetal assessment as variation in its amount has been related to a variety of pregnancy complications.[1,2] Amniotic fluid assessment is an essential part of evaluation of maternal and fetal health in terms of fetal distress, meconium aspiration, termination of pregnancy by caesarean section, Intra uterine growth restriction (IUGR), Non-reassuring fetal heart rate patterns, birth asphyxia, low Apgar-scores at birth and Neonatal intensive care unit Admissions.[3] It is also associated with maternal morbidity in the form of congenital malformations, increased rate of induction or operative interference. Early detection of oligohydramnios and its management may help in reduction of perinatal morbidity and mortality on one side and decreased caesarean deliveries on the other side. Since Oligohydramnios has got significant impact on neonatal outcome and maternal morbidity, it prompted us to do this study.

Amniotic fluid index, as described by Phelan and co-workers, in 1987, remains one of the most commonly used methods of amniotic fluid volume assessment. In this method, the ultrasound transducer is held perpendicular to the floor and parallel to the long axis of the pregnant women. The uterus is divided into four equal quadrants – the right and left upper and lower quadrants, respectively. The AFI is the sum of the single deepest pocket from each quadrant. A fluid pocket may contain fetal parts or umbilical cord loops but these are not included in the measurement.[4] The normal range for AFI that is most commonly used is 5 to 24 cm, with values above and below this indicating hydramnios and oligohydramnios respectively.[5]

Oligohydramnios is defined as an Amniotic Fluid Index below the 5th centile for the gestational age as per Moore and Cayle.[6] The sonographic diagnosis of oligohydramnios is usually based on an AFI ≤5 cm or on a single deepest pocket of amnionic fluid ≤2 cm.[7] Phelan defined oligohydramnios as amniotic fluid index (AFI) ≤5 cm and borderline oligohydramnios as AFI between 5 and 8 cm between 36-42 weeks of gestation.[4] It complicates approximately 1 to 5 percent of pregnancies at term.

Objectives

The aim of our study was to determine the correlation of reduced amniotic fluid index (AFI) with maternal outcome in terms of – Meconium stained liquor, Non Stress test (NST) ,Period of gestation at birth, Mode of delivery (spontaneous or induced normal vaginal delivery, elective or emergency LSCS), Correlation of maternal outcome with severity of oligohydramnios.

Materials and Methods

The study was conducted in the department of Obstetrics & Gynaecology, LLRM Medical College, Meerut

Study type: This was a prospective observational study.

Study duration: Sixteen months

Study period: June 2015 to September 2016.

Study subjects: 200 cases of antenatal women who attended or got admitted, out of which 100 cases with AFI ≤ 8 (oligohydramnios) as study group and 100 cases with AFI > 8 but ≤15 as control group as per inclusion and exclusion criteria.

Inclusion criteria

1. Singleton pregnancy
2. Gestational age between 37-42 weeks.
3. Intact membranes at the time of antepartum testing.
4. AFI assessment within seven days of delivery or at onset of labor.
5. Delivering at study institution.
6. No gross congenital anomaly

Exclusion Criteria

1. Multiple pregnancy
2. Malpresentations i.e. Breech or transverse lie
3. Premature rupture of membranes
4. Antepartum haemorrhage
5. Pregnancy with fetal death (IUD)
6. High risk pregnancy (Hypertension, Diabetes, Severe Anemia)
7. Pregnancy with absolute indication for LSCS

Methodology

A careful clinical history was taken from all the patients particularly about age, last menstrual period, history of previous menstrual cycles, history of oral contraceptive use before the last menstrual period, previous obstetric history and obstetric complications.

A thorough clinical examination including blood pressure, presence of pedal edema, pallor was examined. By obstetric palpation gestational age, presentation and amount of liquor was noted. The fetal heart rate was monitored with auscultation and cardiotocography. All preliminary and baseline investigations like hemoglobin estimation, blood grouping and typing and complete urine examination was done. Then patients fulfilling all the inclusion and exclusion criteria were included in the study.

With all the criteria satisfied, all subjects were evaluated in the department of Radiodiagnosis for four-quadrant AFI measurements, as described by Phelan as well as gestational age assessment, fetal presentation, placental localization and to rule out any gross congenital anomaly in the fetus. The gestational age was assessed by standard fetal biometry and those between 37 to 42 weeks of gestation were considered for study. The AFI is the sum of the single vertical deepest pocket from each quadrant. A fluid pocket may contain fetal parts or umbilical cord loops but these are not included in the measurement.[4] Patients having gross congenital malformations and intrauterine fetal death were excluded from the study.

According to the measurement of AFI, two groups were formed as:

- Cases   –   AFI ≤ 8 cm
- Control   –   AFI > 8cm but ≤15 cm

On admission to the labour room an admission NST was done as per WHO protocols. An NST was considered reactive when the baseline fetal heart rate was between 110 and 160 beats per minute and when there were at least two FHR acceleration of 15 beats per minute lasting at least 15 seconds were present within a 20 minute period. An abnormal fetal heart rate tracing was defined as the presence of severe variable or late decelerations or a bradycardia. The diagnosis of fetal distress was based on repetitive decelerations or prolonged bradycardia or meconium staining of liquor. Those with suspicious NST were reassessed after change in maternal position and adequate hydration and included among reactive or non reactive group.

Labour was either spontaneous or induced in both study and control group. During labour intermittent auscultation of fetal heart rate was done to detect any signs of fetal distress. The nature of amniotic fluid was noted at the time of rupture of membrane and was classified as clear, thin meconium stained liquor and thick meconium stained liquor. Progress of labour was monitored on a partogram.

Mode of delivery (vaginal, elective LSCS, or emergency LSCS) and labour management were at the decision of obstetrician in charge.

After delivery the baby was handed over to the attending pediatrician who was unaware of the ultrasound findings.

Records were reviewed for the presence of non reactive NST, abnormal fetal heart rate tracing, induction of labour, mode of delivery, meconium passage, birth weight, Apgar score, neonatal intensive care unit admissions and neonatal deaths.

Data were compared and analyzed. The results are presented as mean±SD. The Chi-square test was used to compare the categorical variables. The p-value<0.05 was considered significant. All the analysis was carried out on SPSS 16.0 version (Chicago, Inc., USA).

Results

The results and observations of the present study are as follows: The patients in both study and control group in our study were comparable in terms of different demographic factors like age, parity, booking status, socioeconomic status, residential background and also period of gestation.
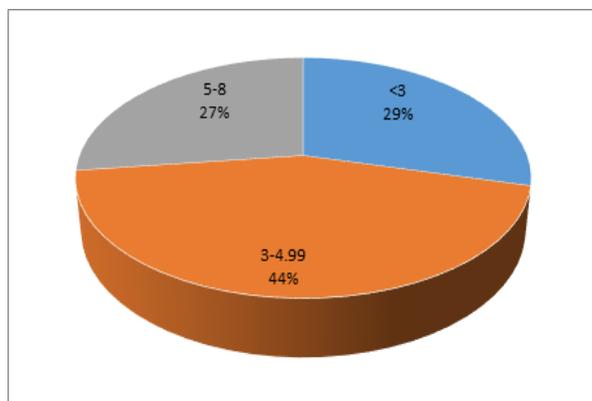
Fig. 1: Distribution of AFI in study group
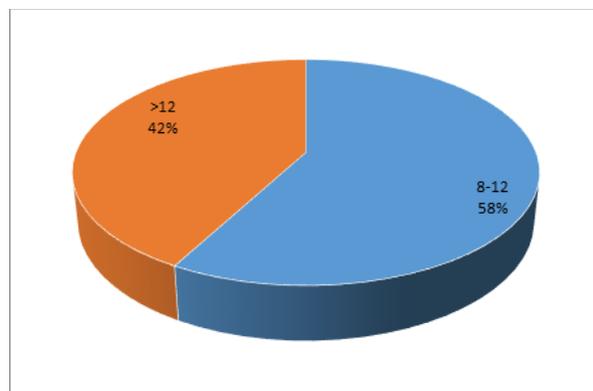
Fig. 2: Distribution of AFI in control group

Fig. 1 shows the distribution of AFI in study group. AFI was moderate (3-4.99 cm) in more than one third of the cases (44%). Severe oligohydramnios (AFI < 3 cm) was present in 29% of patients and mild oligohyramnios (AFI 5-8 cm) in 27% of patients. Fig.2 shows the distribution of AFI in control group. AFI was >12 cm in more than one third of the controls (42%) and 58% had AFI 8 -12 cm.

Table 1: Comparison of mode of delivery with FTVD and LSCS in study and control group

Mode of delivery	Study group		Control group		OR (95%CI), p-value[1]
	No.	%	No.	%	
FTVD	n=49		n=78		
Spontaneous	32	64.6	71	91.0	0.18 (0.06-0.47), 0.0001*
Induced	17	35.4	7	9.0	1.00 (Ref.)
LSCS	n=51		n=22		
Elective	18	35.3	0	0.0	-
Emergency	33	64.7	22	100.0	-

In cases 17 out of 49 (35.4%) of patients were induced and they delivered vaginally while in controls only 7 out of 78 (9%) were induced. The rate of induction was significantly higher in the cases compared to controls than spontaneous (OR=0.18, 95%CI=0.06-0.47, p=0.0001). 18 out of 100 patients in cases underwent elective cesarean for oligohydramnios. There was no elective LSCS among controls as all patients with absolute indications for cesarean section were excluded from the study. 33 patients had emergency cesarean in cases while only 22 in controls. Induction with PGE1 (misoprostol) was done in 56.2% of cases and in 44.4% of controls, rest were induced with PGE2 (cerviprime) in both the groups. Cesarean for fetal distress were higher in cases (78.8% vs 72.7%) but there was no significant (p>0.05) difference in the indications for LSCS between cases and controls.

Table 2: NST pattern and colour of amniotic fluid in study and control group

NST pattern	Study group (n=100)		Control group(n=100)		OR (95%CI), p-value[1]
	No.	%	No.	%	
Reactive	60	60.0	88	88.0	0.20 (0.09-0.42), 0.0001*
Non-reactive	40	40.0	12	12.0	1.00 (Ref.)
Colour of amniotic fluid	n=100		n=100		
Clear	67	67.0	90	90.0	1.00 (Ref.)
Thin MSL	20	20.0	5	5.0	5.37 (1.91-15.04), 0.001*

Thick MSL	13	13.0	5	5.0	3.49 (1.18-10.27), 0.02*

Table 3: Comparison of LSCS for fetal distress with NST in study and control group

NST	Study group (n=26)		Control group(n=16)		OR (95%CI), p-value[1]
	No.	%	No.	%	
Reactive	1	3.8	7	43.8	0.05 (0.01-0.47), 0.001*
Non-reactive	25	96.2	9	56.2	1.00 (Ref.)

40% of the patients in cases had non reactive NST while in controls only 12% had non reactive NST. LSCS for fetal distress in non reactive NST was 96.2% in cases and 56.2% in controls.

Table 4: Comparison of mode of delivery with meconium stained liquor in study and control group- with FTVD and LSCS

Mode of delivery/ Colour of amniotic fluid	Study group		Control group		OR (95%CI), p-value[1]
	No.	%	No.	%	
FTVD	n=49		n=78		
Clear	34	69.4	72	92.3	1.00 (Ref.)
Thin MSL	10	20.4	2	2.6	10.58 (2.19-50.99), 0.003*
Thick MSL	5	10.2	4	5.1	2.64 (0.66-10.48), 0.16
LSCS	n=51		n=22		
Clear	33	64.7	18	81.8	1.00 (Ref.)
Thin MSL	10	19.6	3	13.6	1.81 (0.44-7.46), 0.40
Thick MSL	8	15.7	1	4.5	4.36 (0.50-37.71), 0.18

Meconium stained liquor was found in 33% of cases out of which in 20% had thin meconium and 13% had thick meconium while in controls meconium stained liquor was found in 10% of patients out of which 5% had thin meconium and 5% had thick meconium. In cases Clear liquor was present in 69.4% and meconium stained liquor in 30.6% of cases among those who delivered vaginally while in controls 92.3% had clear liquor and 7.7% had meconium stained liquor. The difference was statistically significant (p<0.05).

Table 5: Comparison of AFI with outcome of labor in study group

Outcome of labor	<3 n=29		3-4.99 n=44		5-8 n=27		p-value[1]
	No.	%	No.	%	No.	%	
FTVD	n=7		n=21		n=21		
Spontaneous	4	16.6	13	27.9	15	55.5	0.90
Induced	3	10	8	18.6	6	25.9	
LSCS	n=22		n=23		n=6		
Elective	12	40	6	13.9	0	0.0	0.02*
Emergency	10	33.3	17	39.5	6	22.2	

The rate of LSCS increases and FTVD decreases as the severity of oligohydramnios increases. The rate of elective cesarean for oligohydramnios was more in those with AFI <3cm (severe oligohydramnios) and there were no elective cesarean in those with AFI 5-8 cm (mild oligohydramnios).

Table 6: Amniotic fluid index as a screening test

	LSCS	FTVD
Cases (AFI < 8)	51 (a)	49 (b)
Controls (AFI ≥ 8)	22 (c)	78 (d)

$$\text{Sensitivity} = \frac{a}{a+c} \times 100 = \frac{51}{51+22} \times 100 = 69.9\%$$

$$\text{Specificity} = \frac{d}{b+d} \times 100 = \frac{78}{49+78} \times 100 = 61.4\%$$

$$\text{Positive predictive value} = \frac{a}{a+b} \times 100 = \frac{51}{51+49} \times 100 = 51\%$$

$$\text{Negative predictive value} = \frac{d}{c+d} \times 100 = \frac{78}{22+78} \times 100 = 78\%$$

The determination of AFI <8 cm as a screening test in predicting rate of LSCS, has a sensitivity of 69.9%, specificity 61.4%, positive predictive value 51% and negative predictive value of 78%.

Discussion

The patients in both study and control group in our study were comparable in terms of different demographic factors like age, parity, booking status, socioeconomic status, residential background and also period of gestation. Comorbid conditions like hypertension, diabetes, severe anemia, antepartum haemorrhage, malpresentations had been excluded from both the groups.

The non-reactive non stress test rates are high in women with oligohydramnios. The rate of non-reactive NST is 40% in study group and 12% in control group in present study and is comparable to results in similar studies as in study by P K Patel et al, Padmini C P et al, Kaur P et al and Kumar P et al it was 65%, 40%, 38%, and 40% respectively.

The occurrence of meconium stained amniotic fluid is high in women with oligohydramnios. The meconium stained liquor was noted in 33% in study group while 10% in control group which is statistically significant and consistent with the studies done before as in Kaur P et al, Padmini C P et al, P K Patel et al meconium stained liquor was found in 48%, 48% and 51% respectively.

In the present study, among cases 49 out of the 100 patients (49%) had vaginal delivery out of which 32 (64.6%) were spontaneous in onset and 17 (35.4%) were induced. 51 patients (51%) underwent lower segment caesarean section. While in controls 78 out of 100 patients (78%) had normal vaginal delivery and 22 (22%) underwent lower segment cesarean section. The most common indication for LSCS was fetal distress followed by non progression of labour. Thus, there was increased risk of obstetric interventions in patients with oligohydramnios in the form of LSCS and was similar to results in various studies like in Padmini C P et al, Kumar P et al , K D Biradar et al , Moses V et al rate of cesarean section were 62%, 63%, 62% and42% respectively.

Induction was with PGE1 (misoprostol) in 56.2% and with PGE2 (cerviprime) in 43.8% of induced patients in cases while in controls 44.4% and 55.6% respectively. Augmentation of labour with oxytocin was done in 12 patients in cases but only 3 patients in controls.

The rate of cesarean section increases and vaginal delivery decreases as the severity of oligohydramnios increases. The rate of elective cesarean for oligohydramnios was more in those with AFI <3cm (severe oligohydramnios) and there were no elective cesarean in those with AFI 5-8 cm (mild oligohydramnios).

Oligohydramnios, leading to fetal distress and hence LSCS for that had predictive effect, with a sensitivity of 69.9 % and negative predictive value of 78%. But the specificity and positive predictive value were 61.4% and 51%. So this can be considered as a screening test for occurrence of fetal distress in intra-partum period requiring cesarean delivery.

Conclusion

Thus this study suggest that oligohydramnios affect the maternal outcome in terms of obstetrical interventions like LSCS for fetal distress, meconium stained liquor and non reassuring fetal heart rate. Early detection of oligohydramnios and its management may help in reducing the rate of caesarean deliveries. Regular antenatal and intranatal monitoring should be done with the help of non stress test and biophysical profile to diagnose any fetal compromise at the earliest. Vaginal delivery and caesarean section should be well balanced so that unnecessary maternal morbidities are prevented and to improve labour outcome.

References

1. Chamberlain PF, Manning FA, Morrison I, et al. The relationship of marginal and decreased amniotic fluid volumes to perinatal outcome. Am J Obstet Gynecol. 1984;150(3):245–49.
2. Nageotte MP, Towers CV, Asrat T, et al. Perinatal outcome with the modified biophysical profile. Am J Obstet Gynecol. 1994;170(6):1672–6.
3. Ali HS. Assessment of amniotic fluid index in normal pregnancy at a tertiary care hospital setting. J Ayub Med Coll Abbottabad, 2009;21:149-151.
4. Phelan JP, Smith CV, Broussard P, et al. Amniotic fluid volume assessment with the four-quadrant technique at 36- 42 weeks' gestation. J Reprod Med 1987;32:540-2.
5. Williams Obstetrics, 24th edition; page 233.
6. Moore TR, Cayle JE: The amniotic fluid index in normal human pregnancy. Am J Obstet Gynecol 162(5):1168,1990.
7. American College of Obstetricians and Gynecologists: Antepartum fetal Surveillance, Practice Bulletin No. 9, October 1999, reaffirmed 2012.
8. Padmini CP, Chaitra R, Indra N, Sriram AM. A prospective study of effect of amniotic fluid index less than 5 at term on perinatal outcome. Int J Reprod Contracept Obstet Gynecol 2016;5:1732-5.
9. Kaur P, Desai DA, Taraiya A. A study on the perinatal outcome in cases of oligohydramnios. Int J Reprod Contracept Obstet Gynecol 2016;5:98-109.
10. Moses V, Thakre S. A study of maternal and fetal outcome in third trimester diagnose case of oligohydramnios. Int J Reprod Contracept Obstet Gynecol 2016;5:2944-8.
11. Biradar KD, Shamanewadi AN. Maternal and perinatal outcome in oligohydramnios: study from a tertiary care hospital, Bangalore, Karnataka, India. Int J Reprod Contracept Obstet Gynecol 2016;5:2291-4.
12. Patel P K Pitre DS, Gupta H. Pregnancy outcome in isolated oligohydramnios at term. Ntl J of Community Med. 2015;6(2):84-8.