Original Research Article

The impact of intrapartum amniotic fluid index on perinatal outcome

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Abstract

Background: Fetal distress in labour is a common occurrence and is of great concern. Evaluation in early labor which could predict the risk of fetal distress could aid in the management of labour.
Aim: The purpose of the study was to determine the value of routine intrapartum amniotic fluid assessment on perinatal outcome.
Materials and methods: Study was done on 240 admitted patients in labou. They had an intrapartum AFI determined by four-quadrant technique subsequently these patients delivered during the same hospitalization. AFI determined was graded as Oligohydramnios was defined as AFI ≤ 5 cm (n = 48), Borderline as AFI 5.1- 8 cm (n = 50), Normal as AFI 8.1-24 cm (n = 142) and Women with AFI > 24 cm were not included in the study. The three groups were compared with regard to intrapartum and postpartum variables.
Results: In present study, 20% of women were in oligohydramnios group, 21% in borderline group and 59% in normal group. Hence, the cesarean section rate for fetal distress was 54% in oligohydramnios and 28% in borderline group. The incidence of instrumental delivery for fetal distress was 12% in oligohydramnios and 14% in borderline. The incidence of APGAR score < 7 at 1 min and 5 min in oligohydramnios and borderline group were respectively 54%, 35%; and 30%, 14%. The incidence of birth weight <2500 gms in oligohydramnios group was 37% and borderline was 24%. NICU admissions in oligohydramnios group were 40% and 8% in borderline group. The percentage of neonatal deaths among oligohydramnios group was 4.2% and nil in borderline. The efficacy of intrapartum determination of oligohydramnios predicting cesarean delivery for fetal distress gave a sensitivity of 64%, specificity of 89%, positive predictive value of 53% and negative predictive value of 93%.
Conclusion: Intrapartum detection of oligohydramnios is a valuable screening test for subsequent fetal distress requiring cesarean delivery.

Key words

AFI, Intrapartum amniotic fluid volume, Fetal distress, Oligohydramnios, Perinatal mortality.

Introduction

Fetal distress in labour is a common occurrence and is of great concern. Evaluation in early labor which could predict the risk of fetal distress could aid in the management of labour. Although clinically it is possible to recognize the development of acute and severe excess of amniotic fluid in their patients, it was difficult to recognize and gross reduction of severe amniotic fluid (oligohydramnios) [1]. It is possible to recognize the quantity of liquor clinically as adequate, excessive or reduced. But the severity of reduced AFI is not possible to be determined accurately. Severe reduction in amniotic fluid is also associated with IUGR, congenital anomalies, post-dated pregnancy, intra partum fetal heart changes & increased fetal morbidity.

The concept of "admission test" was introduced to identify the patients whose ante partum risk factors have been missed, and to triage the patients in early labour into high risk and low risk groups. Cardiotocography for 20 minutes (NST) and response to vibro acoustic stimulation have been used as admission tests [2]. Another variable that has got great impact on the fetal condition in the intrapartum period is amniotic fluid volume. Previously the amount of amniotic fluid was relegated to an "after thought" during amniorrhexis. Now evaluation of amniotic fluid has become an integral part of sonographic evaluation of the gravid patient [2].

Although clinicians were readily able to recognize the development of acute and severe excess of amniotic fluid in their patients, it was difficult to recognize too little amniotic fluid (oligohydramnios) [1]. Oligohydramnios in the ante partum period has been associated with intrauterine growth restriction, post-dated pregnancy, congenital anomalies, increased fetal morbidity and abnormal ante partum fetal heart rate patterns. "Amniotic fluid index" described by Phelan in 1987 is the most accurate method for assessing amniotic fluid volume, and helps categorize the patients into normal, low normal and oligohydramnios groups [3].

AFI as an "admission test" for women presenting in labor ward, after an uneventful pregnancy, could identify patients at risk of fetal distress and thus detect cases needing "SPECIAL SURVEILLANCE". This is superior to the ante partum risk assessment because an immediate evaluation of the current fetal condition could be obtained [2].

Present study was conducted to know the amniotic fluid index in parturients and to assess the effect of this index on the course of labour and perinatal outcome.

Materials and methods

This study was conducted in Department of Obstetrics and Gynaecology, from January to June 2018, to evaluate the usefulness of the amniotic fluid index (AFI), a semiquantitative technique for assessing amniotic fluid volume, in the early intrapartum period for prediction of fetal distress during labor and subsequent fetal morbidity. 240 cases admitted for labor and delivery were selected on the basis of basis of inclusion and exclusion criteria.

Inclusion criteria

- Pregnant women in labour with gestational age ≥37 wks and ≤42 wks.
- Singleton pregnancy
- Cephalic presentation.

Exclusion criteria

- < 37 wks> 42 wks
- Ruptured membranes
- Multifetal pregnancy
- Known fetal malformations
- Abnormal presentation (breech, transverse lie, oblique lie)

- Medical complications like Diabetes mellitus, Pregnancy induced hypertension, Anaemia, Chronic nephritis, Cardiac disease.
- Polyhydramnios (i.e. cases with AFI > 24 cm)

Observations were done on gestational age at delivery, parity, nature of amniotic fluid, mode of delivery, APGAR score at 1 min and 5 min, birth weight, admission to neonatal ward, perinatal morbidity and mortality.

For all the selected cases thorough history was taken and complete examination was done and the data collected was recorded in the proforma. For all the women in the study group amniotic fluid index was determined by four quadrant technique. The results of AFI were blind to the physicians managing the patients' labor.

Amniotic fluid index technique:

- Position of patient was supine.
- A linear, curvilinear, or sector transducer was used.
- Divide the uterus into four quadrants using the maternal sagittal midline vertically, and the upper edge of the uterine fundus.
- The transducer must be kept parallel to the maternal sagittal plane and
- Perpendicular to the maternal coronal plane throughout.
- The deepest unobstructed and clear pocket of amniotic fluid is visualized, and the image frozen. The ultrasound calipers were manipulated to measure the pocket in a strictly vertical direction.

The process was repeated in each quadrant and the pocket measurements summed=AFI. If the AFI was <8cm, perform the four quadrant evaluation three times and average the values. Only those women with previous regular cycles and the gestational age calculated by clinical examination and or ultrasound were taken for study.

Descriptive data were presented as number and percentages with mean and standard deviation wherever required. Chi-square test was used for analyzing data. Students' 't' test was used for comparing mean between two groups. A p-value of 0.05 or less was considered statistically significant. Diagnostic validity test was performed to predict LSCS done for fetal distress using intrapartum Amniotic fluid index.

Results

This study was conducted in 240 term patients who were admitted for a period of one year. 81% were from 21-30 year of age. Oligohydramnios group 27% were primi and 73% were multigravida. Among border line group 36% were primi and 64% were multigravida. Among normal group 27% were primi and 73% were multigravida (**Table – 1**).

It was observed that among oligohydramnios group 46% of women were between 37-40 weeks of gestation and 54% were between 40-42 weeks of gestation which was a normal finding as amniotic fluid volume decreases with increasing gestational age. Among borderline group 56% were found between 37-40 weeks and 44% between 40-42 weeks. Among normal group 83% of women were found between 37-40 weeks and 17% between 40-42 weeks. Gestational age distribution in 3 groups had a chi-square value of 28.5 with a p- value of < 0.05, which is statistically significant.

20% of women were in oligohydramnios group, 21% in borderline group and 59% in normal group. The oligohydramnios and borderline groups were individually compared with normal group with regard to maternal age, gravidity, parity and gestational age and matched (**Figure – 1**).

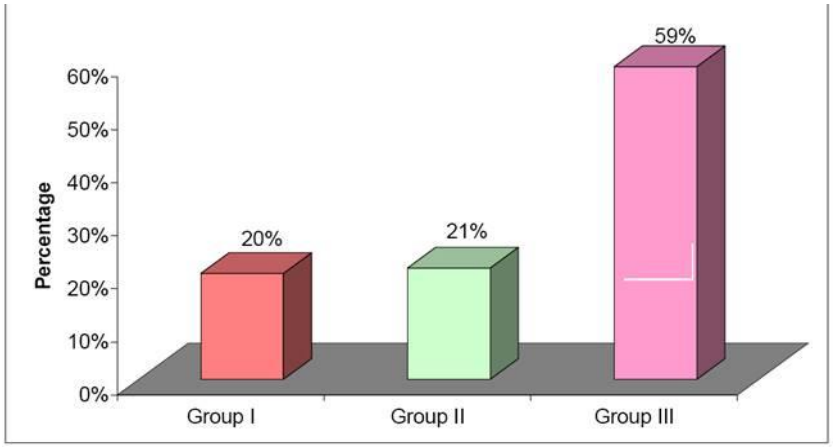
Thick meconium stained liquor was seen in 50% of women among oligohydramnios group, 15% of women among borderline group and 5.0% of women among normal group. The incidence of thick meconium stained liquor was high in the

oligohydramnios group (I). The nature of amniotic fluid in different groups had a chi-square value of 69.9 and a p-value of < 0.05 which was statistically significant (**Table – 2**).

Table - 1: Age Distribution.

AFI (cm)	**GROUP - I**		**GROUP - II**		**GROUP - III**	
Age (years)	**n**	**%**	**n**	**%**	**n**	**%**
18 - 20	9	19	11	22	23	16
21 - 30	39	81	39	78	119	84
>30	0	0	0	0	0	0
TOTAL	48	100	50	100	142	100
Parity						
Primi	13	27	18	36	38	27
Multi	35	73	32	64	104	73
Total	48		50		142	
Gestational Age in weeks						
37-40	22	46	29	56	118	83
40-42	26	54	23	44	24	17

Figure - 1: Distribution of cases among different groups.



48 women in group I 29.1% had normal delivery, 12.5% instrumental and 58.3% cesarean delivery. In the 50 women in group II, 62% had normal delivery, 14% instrumental and 24% cesarean. Among the 142 women in group III 87.3% had a normal delivery, 7.7% instrumental and 4.9% cesarean. The difference in the mode of delivery was found to be statistically significant between three groups ($p < 0.05$).

Percentage was calculated for the corresponding sizes of each group. Hence the total was not 100%. Outlet forceps delivery was conducted in 10.4% of women among oligohydramnios group, 4% of women in borderline group and 3% of women in normal group. Vacuum delivery was conducted in 2.08% of women among oligohydramnios group, 10% of women among borderline group and 4.2% of women among normal group. This indicated that the incidence of instrumental delivery was high among oligohydramnios and borderline group of women in the present study. No complications of instrumental delivery were noted in the present study.

Fetal distress in 54.16% of women among oligohydramnios group, 28% in borderline group and 2.81% among normal group (**Table – 3**).

This indicated a high incidence of cesarean delivery for fetal distress in oligohydramnios group. Emergency cesarean delivery done for other obstetric indications among normal group was CPD in labor, prolonged 2nd stage and deep transverse arrest. No patients required elective LSCS in our study for oligohydramnios.

Table - 2: Nature of amniotic fluid and mode of delivery among different groups.

Nature of amniotic Fluid	Group I	%	Group II	%	Group III	%	P Value
Thin	7	15	12	24	10	7	0.000 *
Thick	24	50	7	14	7	5	
Clear	17	35	31	62	125	88	
Total	48	100	50	100	142	100	
Mode of delivery							
Normal delivery	14	29.1	6	12.5	28	58.3	0.000*
Instrumental Delivery	31	62	7	14	12	24	
Cesarean delivery	124	87.3	11	7.7	7	4.9	
Instrumental Deliveries							
Outlet forceps	5	10.4	2	4	5	3.5	<0.05
Vacuum	1	2.08	5	10	6	4.2	

Table - 3: Emergency cesarean section indications and APGAR score in 3 different groups.

Indications	Group I	%	Group II	%	Group III	%
Fetal distress n – 33	26	54.1	14	28	4	2.8
CPD in labor n–3	1	2.08	1	2	1	0.7
Prolonged second stage n - 1	-	-	-	-	1	0.7
Failure to progress n - 1	1	2.08	-	-	-	-
Deep transverse arrest n - 1	-	-	-	-	1	0.7
APGAR scores < 7 at						
1 min	26	54.1	15	30	6	4.2
5 min	17	35.4	7	14	4	2.8

Table – 4: Birth weight (in gms) among different groups.

Birth wt (in gms)	Group I	%	Group II	%	Group III	%
< 2500	18	37.5	12	24	8	5.63
2501-3000	18	37.5	23	46	82	57.7
3001-3500	10	20.8	15	30	42	29.5
3501-4000	2	4.1	-	0	10	7.04
Total	48	100	50	100	142	100

(X^2= 33.7, p =0.000 < 0.05 Significant)

APGAR score <7 at 1 min were seen in 54.16% of women among oligohydramnios group, 30% women among borderline group and 4.2% of women in normal group.

APGAR score <7 at 5 min were seen in 35.4% of cases among oligohydramnios, 14% among borderline and 2.81% in normal group. The incidence of low APGAR (<7) at 1 min was high among oligohydramnios and borderline group of women. The difference in the value of APGAR scores between 3 groups at both 1 and 5 min was statistically significant.

The difference in the birth weights among different groups had a chi-square value of 33.7 and a p value of 0.05 which was statistically significant (**Table – 4**).

Figure - 2: Incidence of NICU admissions in different groups.

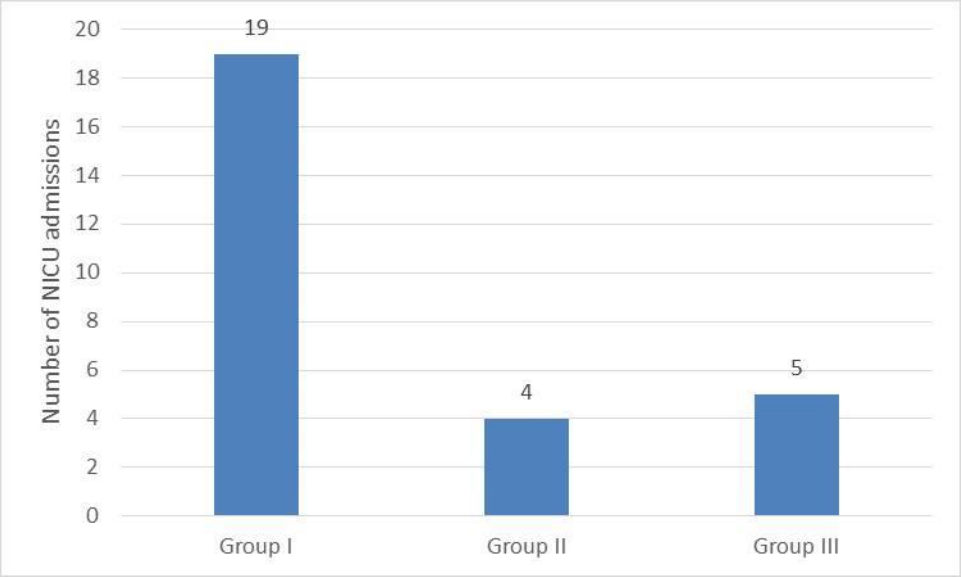


Table - 5: Results by using AFI as screening test.

Screening test	**LSCS for fetal distress**		
AFI	**+**	**-**	**Total**
≤5	25 TP	23 FP	48
>5	19 FN	173 TN	192
Total	44	196	240

(TP- True positive, FP - False positive, FN – False negative, TN – True negative).

Percentage was calculated for the corresponding sizes of each group. Hence the total was not 100%. X^2= 46.09, p=0.000< 0.05, Significant. 39.5% of neonates had NICU admissions among oligohydramnios group, 8% among borderline group and 3.5% among normal group for various indications, the most common being birth asphyxia and meconium aspiration. Oligohydramnios and borderline group of women were associated with more morbidity compared to other group. In the present study three neonatal deaths were seen among oligohydramnios group with birth weight < 2500 gm. The causes being hypoxic ischemic encephalopathy in one and meconium aspiration syndrome in two. The NICU admissions in different groups had a chi-square of 46.09 and p value < 0.05 which was statistically significant (**Figure – 2**).

In the present study: Sensitivity was 57%, Specificity 88%, Positive predictive value 52%, Negative predictive value 90%, Accuracy 83% (**Table – 5**).

The difference in the value of APGAR scores at 1 min and 5 min was statistically significant between oligohydramnios and normal amniotic fluid volume group.

Birth weights < 2500 gms was seen more in oligohydramnios group (37.5%) and borderline group (24%). Low birth weight is a feature of oligohydramnios as IUGR is common in oligohydramnios because of placental insufficiency. The incidence of NICU admissions was high among oligohydramnios group (39.5%) and borderline group (8%). Most common

indication was birth asphyxia and meconium aspiration.

There were 3 early neonatal deaths in the whole study. All three in oligohydramnios group with a birth weight < 2500 gms, the causes being hypoxic ischemic encephalopathy in one and meconium aspiration syndrome in two.

Discussion

Amniotic fluid volume is known to reduce with advancing gestational age. In the present study, 55% of women among oligohydramnios group, 42.8% among borderline group and 16.9% among normal group were seen with gestational age in between 40-42 weeks.

In the present study the incidence of thick meconium stained liquor was high among oligohydramnios group accounting for 50% of women and is comparable with the study conducted by Rutherford, et al. [4], (1987) (54%). The studies by Sarno, et al. [2], (1990) showed 41.9% incidence, and Raj Sriya, et al. [5], (2001) 38.88% incidence of thick meconium stained amniotic fluid in the oligohydramnios group (**Table – 6**).

Table - 6: Comparison of our study with other studies.

Studies	**Occurrence of thick meconium stained liquor among different groups (%)**		
	Group I	**Group II**	**Group III**
Rutherford, et al. [4], (1987)	54	35	19
Sarno, et al. [2], (1990)	41.9	-	27.8
Raj Sriya, et al. [5], (2001)	38.88	-	18.5
Present study	50	14.2	4.9
LSCS for fetal distress (%)			
Rutherford, et al. [4], (1987)	11	1	5
Sarno, et al. [2], (1990)	11.9	-	2.5
Raj Sriya, et al. [5], (2001)	43.05	0	12.5
Present study	54.16	28	2.816

Table - 7: APGAR score <7 at 1 min and 5 min among different groups (%).

Studies		**Group I**	**Group II**	**Group III**
Rutherford, et al. [4] (1987)	1 min	30	16	12
	5 mins	11	2	2
Sarno, et al. [2] (1990)	1 min	26.2	-	12.7
	5 mins	0	-	0.4
Raj Sriya, et al. [5] (2001)	1 min	38.88	-	25
.	5 mins	9.72	-	8.33
Present study	1 min	54.16	30	4.22
	5 mins	35.4	14	2.8

In the present study incidence of cesarean delivery for fetal distress was 54.16% among oligohydramnios group. This is comparable with the study conducted by Raj Sriya, et al. [5], (43.05%). The incidence in the studies conducted by Rutherford, et al. [4], was (11%) and Sarno, et al. [2], was (11.9%). Among borderline group 28% of women had fetal distress in the present study. This is not comparable with any of the above mentioned studies. In the present study 2.8% of women in normal group had fetal

distress which is comparable with the study conducted by Sarno, et al. [2], (2.5%).

APGAR score < 7 at 1 min was seen in 54.16% of cases among oligohydramnios group in the present study, 30% in the study conducted by Rutherford, et al. [4], and 38.88% in the study conducted by Raj Sriya, et al. [5], and 26.2% by Sarno, et al. [2]. Incidence of low APGAR score at 1 min in the borderline and normal group was 30% and 4.2% which is not comparable with the studies by other authors. In the present study, APGAR score < 7 at 5 min was seen in 35.4% of cases among oligohydramnios, 14% among borderline group. Among normal group 2.8% women had AGAR score <7 at 5 min which is comparable with the study conducted by Rutherford, et al. [4] (2%) as per **Table - 7**.

Table - 8: Occurrence of birth weight < 2500 gm.

Studies	**Occurrence of birth weight <2500 gm in %**		
	Group I	**Group II**	**Group III**
Raj Sriya, et al. [5] (2001)	58.38	-	36.11
Present study	37.5	24	5.63
NICU admissions			
Baron C, et al. [6] (1995)	8.2	6.9	9.8
Raj Sriya, et al. [5] (2001)	88.88	-	52.8
Present study	39.5	8	3.52

In the present study, incidence of low birth weight was 37.5% in oligohydramnios group and 5.63% in normal group and 58.38% and 36.11% respectively in the study conducted by Raj Sriya, et al. [5] (2001). But the high incidence of low birth weights in oligohydramnios suggests the association between them. The association can be explained by placental insufficiency which is a causative factor in both of them (**Table – 8**).

In the present study, the incidence of NICU admissions among oligohydramnios group was 39.5%. But, in the studies conducted by Raj Sriya, et al. [5], it was even more higher, 88.88% and 8% in the study by Baron C, et al. [6]. Incidence of NICU admissions among borderline group was 7.14% which is comparable to the study conducted by Baron C, et al. [6] (6.9%). In the present study the incidence of NICU admissions was 3.5% in the normal group and 9.8% in the study by Baron C, et al. [6], and 52.8% in the study by Raj Sriya, et al. [5].

Other studies also done the impact of amniotic fluid assessed intrapartum an perinatal outcome, Relationship between normal amniotic fluid index and birth weight in term patients presenting for labor and Isolated oligohydramnios is not associated with adverse perinatal outcomes which is useful adjunct to fetal surveillance [7-9].

Conclusion

AFI ≤ 5 cm is associated with high incidence of thick meconium stained liquor, fetal distress, operative delivery and cesarean section for fetal distress, poor APGAR score, low birth weight, meconium aspiration and perinatal mortality and morbidity. AFI when used as an “admission test” in intrapartum period can categorise the fetuses into “high risk” and “low risk” depending on their susceptibility to fetal distress. Intrapartum assessment of amniotic fluid index is better than antepartum fetal assessment, as for evaluation of current fetal condition can be done.

Amniotic fluid index is useful adjunct to other fetal surveillance methods, to identify those infants at risk of poor perinatal outcome. In the present study AFI had a sensitivity of 57% and specificity of 88%.

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