Original Research Article

Maternal and perinatal outcomes, and associated factors in isolated borderline oligohydramnios: a cross-sectional analytical study

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ABSTRACT

Background: Borderline oligohydramnios is associated with adverse perinatal outcomes. This study aimed to assess the impact of borderline oligohydramnios on maternal and perinatal outcomes, focusing on mode of delivery, fetal distress, neonatal morbidity, and NICU admissions.

Methods: A cross sectional analytical study comprising 80 antenatal mothers (≥34 weeks) with borderline oligohydramnios was conducted at an Indian hospital. Data were collected through a semi-structured questionnaire and case record reviews. Maternal and perinatal outcomes were analyzed, including mode of onset and delivery, Apgar scores, NICU admissions, and neonatal morbidity.

Results: The mean (SD) age of the participants was 24.5 (2.1) years. Induced labor was prevalent (41%), with 7% of infants experiencing neonatal morbidity, mainly meconium aspiration and neonatal sepsis. About 60% (n=40) delivered a baby between a weight 2.5 to 3 kg, 63% (n=50) had APGAR score more than 7, 34% (n=27) admitted to neonatal intensive care units, and the main reason for NICU admission was fetal distress (n=44.4%). The reason for neonatal morbidity was meconium aspiration (5%) followed by neonatal sepsis (2.5%). Non-reassuring NST and amniotic fluid nature significantly correlated with NICU admissions, while age and AFI influenced delivery mode.

Conclusions: Borderline oligohydramnios led to a high rate of induced labor, yet neonatal morbidity was relatively low. Non-reassuring NST and amniotic fluid nature significantly impacted NICU admissions. Further research on a larger scale is warranted to validate these findings for widespread implementation.

Keywords: Labour, Maternal outcomes, NICU, Obstetrics

INTRODUCTION

Amniotic fluid, a vital component of fetal development, acts as a protective cocoon, shielding the growing fetus from mechanical and biological harm, and enabling essential physiological processes.[1] Over the years, various methods have been employed to measure and assess amniotic fluid volume, with the four-quadrant method gaining widespread acceptance among researchers.[2] Recognized as a medium that facilitates fetal movement, aids in the maturation of vital organs, and safeguards against umbilical cord compression, amniotic fluid plays a pivotal role during pregnancy.

The significance of amniotic fluid becomes particularly pronounced when its levels deviate from the normal range. Oligohydramnios, characterized by abnormally low amniotic fluid volume, poses substantial risks, leading to adverse pregnancy outcomes.[3] Studies have linked oligohydramnios with complications such as meconium aspiration, intrauterine growth restriction, stillbirth, and neonatal mortality.[4-6] Moreover, it heightens the likelihood of maternal complications, necessitating interventions like induced labor and cesarean deliveries.[2]

Despite the established association between oligohydramnios and adverse outcomes, the impact of isolated borderline oligohydramnios remains a subject of debate. This ambiguity necessitated our exploration into

the clinical and epidemiological aspects of patients experiencing this condition, aiming to shed light on its effects on both maternal and perinatal outcomes. Therefore, this study aimed to explore the consequences of isolated borderline oligohydramnios for both mothers and newborns during pregnancy.

METHODS

Study design and setting

This cross sectional analytical study was conducted at the outpatient department (OPD) of obstetrics and gynaecology, Christian fellowship hospital, Dindigul, India.

Study population

All antenatal mothers with gestational age ≥34 weeks with borderline oligohydramnios and without any high-risks factors attending the OPD of obstetrics and gynaecology, Christian fellowship hospital, Dindigul, India were eligible to participate in the study. The study included singleton pregnancies between 34 and 40 weeks of gestation with an amniotic fluid index between 5 and 8 cm, and intact membranes. Excluded were cases with previous cesarean sections, multiple gestations, ruptured membranes, polyhydramnios, medical conditions such as pre-eclampsia, diabetes, or heart diseases, as well as cases with malpresentation.

Study duration

This study was conducted between October 2020 and March 2021.

Sample size

Assuming the proportion of low weight babies as 71%, with 10% absolute precision, 95% confidence interval, the calculated sample size for the study was 80.[7] This sample size was calculated by using OpenEpi version 3.01.

Sampling technique

The sampling technique used for the present study was convenient sampling technique. All the eligible patients satisfying the inclusion criteria were selected from the OPD till the required sample size was achieved.

Data collection

Data collection period was six months. The investigator introduced themselves and established a good rapport with the study participants. The desire for conducting the study was explained to them. It was assured to them that all data would be kept strictly confidential and used only for the study purpose. After obtaining the written consent from the participant, the investigator conducted an interview for collecting information on sociodemographic and clinical

characteristics. A pretested semi-structured questionnaire was used to assess the sociodemographic and clinical characteristics. Patients case records were reviewed to get the details of treatment history. All the women in the study were followed up till delivery to measure the outcomes.

AFI calculated based on the four-quadrant amniotic fluid volume measurement technique. The uterus was arbitrarily divided into four quadrants by the umbilicus transversely and the Linea nigra vertically. The largest vertical pocket free of fetal parts and loops of cord in each quadrant was measured and added to give the AFI. Patient found to have borderline oligohydramnios for the same formed the subjects of the study.

During the follow up period, onset of labour, induction of labour, mode of delivery, FHR tracing, and nature of amniotic fluid were assessed. Perinatal outcomes like APGAR scores, birth weight, and NICU admission were noted. Infants were followed up until NICU discharge or transfer or death and neonatal morbidity was assessed.

Study variables

Independent variables

Age, gestational age, and parity of the mother are considered independent variables in this study, reflecting demographic and physiological aspects. Additionally, the amniotic fluid index (AFI) and indication of lower segment cesarean section (LSCS) were key variables representing the amniotic fluid levels and the reason for cesarean delivery, respectively.

Outcome variables

These include the onset of labor, the mode of delivery and Neonatal Intensive Care Unit (NICU) admission status.

Statistical analysis

Data will be entered to Microsoft excel and analysis will be done using STATA version 14. Categorical variables such as age group, gestational age, parity, AFI, mode of onset of labour, NST, nature of amniotic fluid, mode of delivery, indication of LSCS, birth weight and APGAR scores were summarised as frequency and percentages. Outcome variables such as NICU admissions and neonatal morbidity were summarised as percentages with 95% confidence intervals (CIs). The association of sociodemographic and clinical feature with NICU admissions and neonatal morbidity were analysed using chi squared test. A p value less than 0.05 was considered as statistically significant.

Ethical issues

The ethical approval was obtained from the institutional review board (IRB) of Meenakshi missions' hospital, Madurai. Written informed consent was obtained from

each participant who participated in the research study before enrolling. The researchers explained the details of the study and detailed the purpose of the study to the participants. Confidentiality was maintained throughout the period of data collection. Confidentiality was maintained by limiting the identifying variables to the minimum. Data was analysed in aggregate and access to the collected data was limited only to me, my guide and co-guide. All information related to the study participants were kept confidential and de-identified data was used for analysis.

RESULTS

Table 1 provides a comprehensive overview of the demographic and clinical characteristics of 80 participants in the study.

Table 1: Demographic and clinical features (N=80).

Variables	N	%
Age in years		
<20	22	27.5
21-29	49	61.3
≥30	9	11.3
Gestational age (weeks)		
34-36	14	17.5
36-38	27	33.7
38-40	39	48.8
Parity		
Primi	53	66.3
Multi	27	33.7
Amniotic fluid index		
5	18	22.5
6	26	32.5
7	29	36.3
8	7	8.7
Onset of labour		
Spontaneous	33	41.3
Induced	47	58.7
NST		
Reassuring	60	75
Non-reassuring	20	25
Nature of amnitic fluid		
Clear	42	52.5
Grade 1 MSL	8	10
Grade 2 MSL	23	28.8
Grade 3 MSL	7	8.7
Mode of delivery		
Vaginal	30	37.5
Vaginal instrumental	31	38.8
LSCS	19	23.7
Indication for LSCS		
Fetal distress	8	42.1
MSL	8	42.1
Non progression of labour	3	15.8
Birth weight (kg)		
<2	0	0
2-2.5	25	31.3
2.5-3	48	60
>3	7	8.7
APGAR score		
<7/10	30	37.5
>7/10	50	62.5

Continued.

Variables	N	%
NICU admission		
Yes	27	33.8
No	53	64.2
Reason for NICU admissions		
Fetal distress	12	44.4
LBW	6	22.2
MSAF with fetal distress	9	33.3
Neonatal morbidity		
Normal	74	92.5
Meconium aspiration	4	5
Neonatal sepsis	2	2.5
Early neonatal death	0	0

Table 2: Factors associated with onset of delivery.

Variables	Total	Onset of delivery		P value
		Spontaneous n (%)	Induced n (%)	
Age (years)				
<20	22	8 (36.4)	14 (63.6)	
21-29	49	20 (40.8)	29 (59.2)	0.612
≥30	9	5 (55.6)	4 (44.4)	
Gestational age (weeks)				
34-36	14	5 (35.7)	9 (64.3)	
36-38	27	9 (33.3)	18 (66.7)	0.412
38-40	39	19 (48.7)	20 (51.3)	
Parity				
Primi	53	21 (39.6)	32 (60.4)	0.679
Multi	27	12 (44.4)	15 (55.7)	
AFI				
5	18	7 (38.9)	11 (61.1)	
6	26	11 (42.3)	15 (57.7)	0.996
7	29	12 (41.4)	17 (58.6)	
8	7	3 (42.9)	4 (57.1)	

Table 3: Factors associated with mode of delivery.

Variables	Total	Mode of delivery			P value
		Vaginal n (%)	Vaginal instrumental n (%)	LSCS n (%)	
Age (years)					
<20	22	14 (63.6)	4 (18.2)	4 (18.2)	
21-29	49	16 (32.7)	20 (40.8)	13 (26.5)	0.007
≥30	9	0	7 (77.8)	2 (22.2)	
Gestational age (weeks)					
34-36	14	5 (35.7)	5 (35.7)	4 (28.6)	
36-38	27	10 (37.0)	13 (48.2)	4 (14.8)	0.674
38-40	39	15 (38.5)	13 (33.3)	11 (28.2)	
Parity					
Primi	53	22 (41.5)	17 (32.1)	14 (26.4)	0.229
Multi	27	8 (29.6)	14 (51.9)	5 (18.5)	
AFI					
5	18	8 (44.4)	3 (16.7)	7 (38.9)	
6	26	4 (15.4)	14 (53.9)	8 (30.8)	0.018
7	29	13 (44.8)	12 (41.4)	4 (13.8)	
8	7	5 (71.4)	2 (28.6)	0	
Mode of delivery					

Variables	Total	Mode of delivery			P value
		Vaginal n (%)	Vaginal instrumental n (%)	LSCS n (%)	
Spontaneous	33	9 (27.3)	17 (51.5)	7 (21.2)	0.13
Induced	47	21 (44.7)	14 (29.8)	12 (25.5)	

Table 4: Maternal and child factors associated with NICU admission (N=80).

Variables	Total	NICU admission		P value
		Yes n (%)	No n (%)	
Age (years)				
<20	22	6 (27.3)	16 (72.7)	
21-29	49	16 (32.7)	33 (67.3)	0.308
≥30	9	5 (55.6)	4 (44.4)	
Gestational age (weeks)				
34-36	14	4 (28.6)	10 (71.4)	
36-38	27	9 (33.3)	18 (66.7)	0.882
38-40	39	14 (35.9)	25 (64.1)	
Parity				
Primi	53	16 (30.2)	37 (69.8)	0.345
Multi	27	11 (40.7)	16 (59.3)	
AFI				
5	18	7 (38.9)	11 (61.1)	
6	26	9 (34.6)	17 (65.4)	0.702
7	29	10 (34.5)	19 (65.5)	
8	7	1 (14.3)	6 (85.7)	
Onset of delivery				
Spontaneous	33	15 (45.5)	18 (54.6)	0.064
Induced	47	12 (25.5)	35 (74.5)	
NST				
Reassuring	60	9 (15.0)	51 (85.0)	<0.001
Non-reassuring	20	18 (90.0)	2 (10.0)	
Nature of amniotic fluid				
Clear	42	9 (21.4)	33 (78.6)	
Grade 1 MSL	8	2 (25.0)	6 (75.0)	0.022
Grade 2 MSL	23	11 (47.8)	12 (52.2)	
Grade 3 MSL	7	5 (71.4)	2 (28.6)	
Mode of delivery				
Vaginal	30	6 (20.0)	24 (80.0)	
Vaginal instrumental	31	13 (41.9)	18 (58.1)	0.131
LSCS	19	8 (42.1)	11 (57.9)	
Birth weight (kg)				
2-2.5	25	12 (48.0)	13 (52.0)	
2.5-3	48	13 (27.1)	35 (72.9)	0.191
>3	7	2 (28.6)	5 (71.4)	
APGAR				
<7	30	13 (43.3)	17 (56.7)	0.16
>7	50	14 (28.0)	36 (72.0)	

In terms of age, the majority of participants (61.3%) were between 21 and 29 years old. Gestational age varied, with 48.8% of participants falling between 38-40 weeks. Primiparous women constituted 66.3% of the sample. Amniotic fluid index ranged from 5 to 8, with the most common score being 7 (36.3%). Labor onset was split between spontaneous (41.3%) and induced (58.7%). Non-stress tests yielded reassuring results for 75% of participants. Vaginal instrumental delivery was slightly more common (38.8%) than standard vaginal delivery (37.5%). Notably, 60% of infants had a favorable APGAR score (>7/10) and the majority (92.5%) exhibited normal neonatal health. Neonatal intensive care unit (NICU)

admission was necessary for 33.8% of infants, primarily due to fetal distress.

Table 2 compares onset of delivery (spontaneous versus induced) across various factors. Age, gestational age, parity, and amniotic fluid index (AFI) levels (5, 6, 7, 8) do not show significant influence on the mode of delivery. Table 3 explores factors impacting mode of delivery. Younger mothers (<20 years) prefer vaginal births, while those ≥30 years tend towards LSCS (p=0.007). AFI of 5 links with more LSCS, AFI of 6 with vaginal instrumental deliveries (p=0.018). Primiparous women favor vaginal births, whereas multiparous women opt for instrumental methods. Onset of labor (spontaneous or induced) doesn't significantly influence delivery mode.

Table 4 summarizes factors influencing NICU admissions. Non-reassuring NST results (p<0.001) and the nature of amniotic fluid (p=0.022) were significantly correlate with higher NICU admissions (p<0.05). Induced deliveries and birth weights between 2-2.5 kg show trends, but without statistical significance. Other factors, including maternal age, gestational age, parity, AFI, mode of delivery, and APGAR scores, do not exhibit significant associations with NICU admissions.

DISCUSSION

Borderline oligohydramnios has always created a management and consultation dilemma for obstetricians. The current study found that the incidence of induced labour among pregnant women with isolated borderline oligo-hydramnios was 59% and 24% had mode of delivery as LSCS. These findings are similar to the studies conducted by Shrem et al and Rathod et al.[8,9] The main cause for induced labour were fetal distress (42%), MSL (42%), non-progression of labour (16%). A study conducted by James et at found that the about 51% of caesarean section in their study was due to fetal distress, which is almost similar to the current study findings.[10] Majority of the babies had a normal body weight at birth and APGAR scores were more than 7 for almost two third of the patients.

In our study, although the indications for cesarean section were fetal distress and/or umbilical cord compression, surprisingly no babies were born with asphyxia. These results are also strongly correlated with the studies of Ahmad et al.[11] In the preent study, about one third of the infants admitted to NICU. The rate of NICU admissions was recorded high in another study by Manning et al which was reported the incidence as 43%.[10,12] This difference might be due to the study setting. Fetal distress, low birth weight and MSAF with fetal distress were the major reasons for NICU admissions. These findings were similar to the studies by Bachhav et al and Kumar et al Bhagat et al[15] and Figueroa et al also reported a significant association between low birth-weight infants with borderline isolated oligohydramnios although there was no difference in five-minute Apgar score and cord blood

pH.[13-16] Shrem et al found that higher rates of an APGAR score <7 at 1 and 5 minutes was significantly associated with higher admissions to the NICU.[8]

In the current study, only 7% of the infants reported any neonatal morbidity. Meconium aspiration and neonatal sepsis were the morbidities reported. Our findings are similar to the studies conducted by Simonsen et al and Bachhav et al Gumus et al and Banks et al in their studies observed that the NICU admissions were higher in borderline AFI group.[13,17-19] Oligohydramnios demands intensive fetal surveillance and proper antepartum and intrapartum care. AFI is an important component of biophysical profile scoring and its assessment helps to identify women who need antepartum surveillance so that proper management can be done for the improvement of maternal and perinatal outcome. Fetal complications of Oligohydramnios include abortion, fetal pulmonary hypoplasia, cord compression, high fetal mortality, and deformities due to intraamniotic adhesions or due to compression. In our study, age of the mother and AFI were significantly associated with mode of delivery. In another study, an AFI<5was associated with neonatal requiring NICU admissions.[20]

Our study found that the nature of the amniotic fluid was significantly associated with neonatal morbidities. Studies have already proven that the nature and volume of amniotic fluid significantly affects the perinatal outcome.[21] Nature of the amniotic fluid is a predictor of fetal tolerance during labour, and its alterations is associated with an increased risk of abnormal heart rhythms and meconium fluid. Phelan et al studied amniotic fluid index during pregnancy and concluded that its usefulness in the evaluation of fetal monitoring throughout pregnancy.[22] Mode of delivery were significantly associated with neonatal morbidities. It is observed that the patients with isolated oligohydramnios had significantly higher rates of cesarean sections and thus increased neonatal morbidities.[8] It is also reported that the associated morbidities were short term rather than leading to neonatal deaths. Thus, from our study we found that the major factors influencing the neonatal morbidities among pregnant women with isolated borderline oligohydramnios are the nature of amniotic fluid and the mode of delivery (LSCS).

This study pioneers research on maternal and neonatal outcomes in isolated borderline oligo-hydramnios, offering valuable insights. It benefits from a well-representative sample, enhancing its power and generalizability.

However, there are few limitations. The hospital-based nature introduced potential selection bias, and the cross-sectional design limited establishing temporal associations. The absence of long-term neonatal follow-up and the influence of high-quality NICU facilities on outcomes were notable limitations. Additionally, fetal distress assessment using FHR tracings instead of fetal acidosis might have affected accuracy.

CONCLUSION

Induced labor was common, and age influenced delivery preferences. NICU admissions were significantly linked to non-reassuring NST results and amniotic fluid nature, while induced deliveries and lower birth weights showed trends without statistical significance. These findings offer important insights into obstetric and neonatal outcomes, underscoring the need for targeted clinical strategies in cases of borderline oligo-hydramnios.

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