

Hydration Therapy to Improve Amniotic Fluid Index and its Association with Improved Obstetric Outcome in a Teaching Hospital of Eastern India

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Abstract

Introduction: Oligohydramnios is associated with fetal complications and a higher incidence of maternal operative morbidity. A study was planned to determine the effect of hydration therapy in the correction of oligohydramnios in pregnancy and to assess if improvement in amniotic fluid index (AFI) is associated with better obstetric outcomes. **Materials and Methods:** Analytical study with a prospective design, conducted over 1 year from July 2020 to December 2021. Pregnant women in their third trimester with singleton pregnancy and intact membranes, diagnosed to have oligohydramnios were the participants. All women undertook oral rehydration therapy. The proportion of women achieving posthydration cutoff values of AFI and single deepest vertical pocket, was recorded by abdominal ultrasound examination at 24, 48, and 72 h. Adequacy of hydration was assessed by urinary specific gravity, before and after hydration therapy. **Results:** There were 120 participants. The mean age of the participants was 25.6 years (standard deviation = 5.7). Majority were multigravida. About 60%–80% of women improved with hydration therapy and the proportion of women showing improvement increased with time. Women with uncorrected AFI (<5 cm) at 24 and 48 h had significantly higher odds of preterm delivery, cesarean delivery, low-birth-weight baby, baby having 5 min Apgar score < 6, higher likelihood of Sick Newborn Care Unit admission and neonatal death. **Conclusion:** Maternal hydration therapy can be of value to improve the fetomaternal outcome in pregnancies with oligohydramnios by preventing preterm termination and reducing cesarean deliveries with good neonatal outcomes. Such simple intervention can be home based and assures universal health coverage.

Keywords: Amniotic fluid index, Apgar score, oligohydramnios

INTRODUCTION

Amniotic fluid volume (AFV) is an important parameter to assess fetal well-being because amniotic fluid is an essential element for intrauterine fetal growth and development.^[1,2] Oligohydramnios is associated with complications such as fetal growth restriction, poor fetal lung development, higher incidence of maternal operative morbidity, congenital malformations, fetal distress due to cord compression, and meconium aspiration.^[1,2] Oligohydramnios happens in 3%–5% of pregnancies and in half of the cases preexisting fetal and maternal risk factors are absent and are therefore called isolated oligohydramnios.^[2] Amnioinfusion can be an option to correct reduced AFV, but it is most useful for the diagnostic purpose

to create an acoustic window for better visualization.^[3] Its therapeutic role is limited and that too during the intrapartum period with ruptured membranes. It is not without risk like other invasive procedures.^[4,5] As a noninvasive option, maternal oral or intravenous hydration therapy had been found to improve AFV in both normal pregnancies and in oligohydramnios.^[6–10] This might be due to increased uteroplacental perfusion or changes in maternal and fetal plasma osmolality resulting in improved fetal urine flow.^[11] However, the clinical benefits

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are yet to be well established. In this prospective study, this simple yet potentially beneficial intervention was planned to be explored with the objectives of:

1. To determine the effect of hydration therapy in the correction of oligohydramnios in pregnancy
2. To find out the proportion of improved amniotic fluid index (AFI) to ≥ 5 cm following hydration therapy
3. To assess if improvement in AFI is associated with better obstetric outcomes.

MATERIALS AND METHODS

Study design

Analytical study with a prospective design.

Study setting

Department of Obstetrics and Gynecology of Calcutta National Medical College and Hospital (CNMCH).

Inclusion and exclusion criteria

The pregnant women in their third trimester with singleton pregnancy and intact membranes diagnosed to have oligohydramnios attending the antenatal clinic were included. Oligohydramnios was defined when AFI by abdominal ultrasonography fell below 5 cm and/or single deepest pocket (SDP) of amniotic fluid measured <2 cm.^[12] Exclusion criteria were incorrect ascertainment of gestational age, anomalous fetus, fetal demise, multifetal gestations, prelabor rupture of membranes, postmaturity, and any maternal medical disorders that may affect AFV.

Sample size

One hundred and twenty-six consecutive women were selected according to the selection criteria.

Study duration

One year from July 2020 to December 2021.

Procedure

All participants had color Doppler (LogiqP9 version GE machine using 2MHzcurvilinear probe) study to exclude compromised fetal growth. All participants diagnosed to have oligohydramnios undertook oral hydration with 2 L of water/day for 72 h over and above normal daily water requirement (3–4 L), irrespective of seasonal variation after admission.^[9] Posthydration AFI and SDP were recorded by abdominal ultrasound examination at 24, 48, and 72 h. The proportion of women achieving cutoff values at each time point was captured. Adequacy of hydration was assessed by urinary specific gravity, before and after hydration therapy. Pregnant mothers before term with corrected AFV were discharged from the hospital after completion of prenatal dexamethasone course with advice to maintain hydration therapy at home in an attempt to continue pregnancy further. Hydration therapy was abandoned, and delivery was conducted for women whose AFV was not corrected after 72 h of hydration. Figure 1 shows the numerical details of participant recruitment.

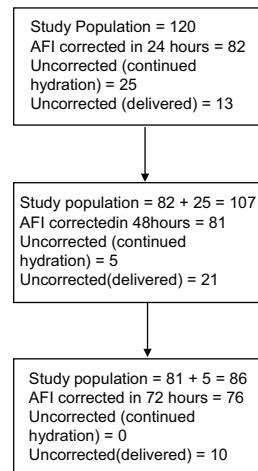


Figure 1: Participant recruitment flowchart. AFI: Amniotic fluid index

Variables

Demographic information such as age, parity, and period of gestation of the study participants was obtained, and data regarding maternal and neonatal outcomes in terms of proportion of operative delivery, birth weight, Apgar score at 5 min after birth, Sick Newborn Care Unit (SNCU) admission, and neonatal deaths were recorded.

Statistical analysis

Data were presented as frequency and proportion for categorical variables and as mean for continuous variables. Fetal-maternal outcome among the responders and nonresponders following hydration therapy was analyzed. Significance for the difference of mean and odds ratio for risk of adverse obstetric outcome for uncorrected AFV at 24, 48, and 72 h were estimated. MedCalc online statistical calculator was used for this purpose.^[13,14]

Ethical conduct

The study had approval from Institutional Ethics Committee, CNMCH and Institutional Review Board; CNMCH with approval number, Memo No GYN/CNMC-91 dated May 06, 2020. The study was compliant with the revised Helsinki Declaration on bioethics policy. All participants provided informed consent. Anonymity and data confidentiality were maintained.

RESULTS

Response rate for this study was (120/126) 95.2%. Data were analyzed for these 120 women with oligohydramnios. Details of participant recruitment are given in Figure 1. It was observed that 88 (73.3%) women were aged below 30 years. The mean age of respondents was 25.6 years (standard deviation = 5.7). One out of every ten women did not complete the primary level of education. Majority of women were multigravida, whereas 44 (36.7%) women were before term at admission, preterm delivery could be reduced to 29 (24.2%). Although most women delivered vaginally, Lower uterine segment Caesarean Section (LSCS) proportion was also high at 41.7% (50 women) [Table 1].

Table 2 shows improvement in AFI and SDP at 24, 48, and 72 h from prehydration level. The proportion of women showing improvement increased with time. The mean urine specific gravity, posthydration was significantly lower (standard error of the mean 0.001, confidence interval -0.03 to -0.02 , $P < 0.001$). Nearly 90% of women improved after 72 h of therapy. This table also shows the mean AFI and SDP values. In every 24 h, there was a significant improvement in mean values.

Table 1: Distribution of study subjects according to their demography and clinical profile ($n=120$)

Variables	Frequency (%)
Age (years)	
≤ 20	23 (19.2)
21-25	34 (28.3)
26-30	31 (25.8)
31-35	28 (23.3)
36-40	4 (3.3)
Religion	
Hinduism	30 (25.0)
Islam	90 (75.0)
Education	
Primary not completed	14 (11.7)
Primary	37 (30.8)
Secondary	49 (40.8)
Tertiary	20 (16.7)
Gravida	
Primigravida	47 (39.2)
Multigravida	73 (60.8)
Period of gestation at admission	
Preterm	44 (36.7)
Term	76 (63.3)
Period of gestation at delivery	
Preterm	29 (24.2)
Term	91 (75.8)
Mode of delivery	
Vaginal delivery	70 (58.3)
Lower uterine cesarean section	50 (41.7)

Table 2: Improvement in oligohydramnios by hydration therapy with time

Increased to $\geq 5\text{cm}$ frequency (%)	Increased to $\geq 5\text{cm}$, frequency (%)	Mean (SD) (cm)	t-statistic
Prehydration	-	4.09 (0.99)	-
Within 24 h ($n=120$)	82 (68.3)	4.72 (1.47)	3.9**
Within 48 h ($n=107$)	81 (75.7)	5.44 (1.61)	3.5**
Within 72 h ($n=86$)	76 (88.4)	6.49 (1.43)	4.7**
Increased to $\geq 2\text{cm}$ frequency (%)	Improvement to $\geq 2\text{cm}$, frequency (%)	Mean (SD) (cm)	t-statistic
Prehydration	-	1.73 (0.25)	-
Within 24 h ($n=120$)	87 (72.5)	2.34 (0.65)	9.6**
Within 48 h ($n=107$)	88 (82.2)	2.71 (0.76)	3.9**
Within 72 h ($n=86$)	78 (90.7)	3.11 (0.69)	3.8**

**Significant at <0.01 . SDP: Single deep pocket, AFI: Amniotic fluid index, SD: Standard deviation

Table 3 presents the obstetric outcomes and its association with AFI at 24, 48, and 72 h of hydration therapy. The variables studied were period of gestation at delivery, mode of delivery, birth weight, 5-min Apgar score, whether newborn was admitted at SNCU, and whether there was neonatal death. Women with uncorrected AFI ($<5\text{ cm}$) at 24 and 48 h had significantly higher odds of preterm delivery, cesarean delivery, low-birth-weight baby, baby having 5 min Apgar score <6 , higher likelihood of SNCU admission, and neonatal death. Lower Apgar score and neonatal death risk were not significant for uncorrected AFI at 72 h. Women were 43 times more likely to have a baby with birth weight $<2.5\text{ kg}$ if oligohydramnios remained uncorrected after 72 h of therapy. They were also 23 times more likely to deliver by cesarean section.

DISCUSSION

The study results show improvement in oligohydramnios over predetermined observation periods of 24, 48, and 72 h with hydration therapy and a higher risk of poor obstetric outcomes among women with uncorrected oligohydramnios.

Few studies have reported AFV is inversely related to adverse pregnancy outcomes including umbilical cord compression, placental insufficiency, and meconium aspiration in the third trimester. Fetal distress resulting from cord compression and placental insufficiency again give rise to increased operative morbidity due to cesarean delivery and poor neonatal outcome.^[15-19] The risk of poor perinatal outcome is more due to shorter gestations with isolated oligohydramnios.^[20] A meta-analysis of 12 studies including a pooled sample of 36000 women showed pregnancies with isolated oligohydramnios were associated with higher rates of labor inductions, cesarean delivery, low Apgar scores, and Neonatal Intensive Care Unit admission compared to those with normal AFV.^[21] Another systemic review and meta-analysis clearly revealed the positive impact of maternal hydration to improve AFV in isolated oligohydramnios and hypotonic solutions were found to be more effective than isotonic fluids.^[22] However, the clinical benefits were not clear due to heterogeneity in patient selection, diagnostic criteria, protocols of hydration therapy, and outcome assessment. In our study, we found women with corrected AFV after hydration therapy had significantly lower preterm births, cesarean delivery, Apgar score <6 at 5 min after birth, and less chance of SNCU admission. Patrelli *et al.* postulated that correction of AFV by maternal hydration might contribute to reducing the cesarean rate for nonreassuring or pathological nonstress tests.^[11] The present study showed that women at term with improved AFI following hydration therapy had a significantly better chance of having babies with birth weight $\geq 2.5\text{ kg}$. Flack *et al.* concluded increase in AFV in the third trimester with oligohydramnios might result from improved uteroplacental perfusion rather than increased fetal urine production after maternal hydration which could have contributed to the higher proportion of normal birth weight in corrected oligohydramnios.^[9] Our study is not free from limitations. It had no comparator group to study the effect on

Table 3: Obstetric outcome among the study participants and its association with amniotic fluid index at 24, 48, and 72 h of hydration therapy

Variable	Category	AFI-24 (n=120)			AFI-48 (n=107)			AFI-72 (n=86)		
		<5 cm	≥5 cm	OR (CI)	<5 cm	≥5 cm	OR (CI)	<5 cm	≥5 cm	OR (CI)
POG	Preterm	20 (52.6)	9 (11.0)	9.0	13 (50)	9 (11.1)	8.0	5 (50)	7 (9.2)	9.8
	Term	18 (47.4)	73 (89.0)	(3.5-23.1)**	13 (50)	72 (88.9)	(2.8-22.5)**	5 (50)	69 (90.8)	(2.3-42.6)**
Mode of delivery	Vaginal	9 (23.7)	61 (74.4)	9.3	8 (30.8)	61 (75.3)	6.9	1 (10)	57 (75)	27.0
	LSCS	29 (76.3)	21 (25.6)	(3.8-23.0)**	18 (69.2)	20 (24.7)	(2.6-18.2)**	9 (90)	19 (25)	(3.2-227.3)**
Birth weight (kg)	<2.5	30 (79.0)	17 (20.7)	14.3	20 (76.9)	16 (19.8)	13.5	9 (90)	13 (18.0)	43.6
	≥2.5	8 (21.0)	65 (79.3)	(5.6-36.9)**	6 (23.1)	65 (80.2)	(4.6-39.2)*	1 (10)	63 (82.9)	(5.0-374.6)**
5 min Apgar	<6	6 (15.8)	1 (1.2)	15.2	4 (15.4)	1 (1.2)	14.5	1 (10)	1 (1.3)	8.3
	≥6	32 (84.2)	81 (98.8)	(1.7-131.2)*	22 (84.6)	80 (98.8)	(1.5-136.8)*	9 (90)	75 (98.7)	(0.5-145.0)
SNCU admission	No	20 (52.6)	74 (90.2)	8.32	14 (53.8)	75 (92.6)	10.7	7 (70)	72 (94.7)	7.7
	Yes	18 (47.4)	8 (9.8)	(3.2-21.9)**	12 (46.2)	6 (7.4)	(3.4-33.3)**	3 (30)	4 (5.3)	(1.4-41.6)*
Neonatal death	No	29 (76.3)	80 (97.6)	12.4	21 (80.8)	80 (98.8)	19.0	9 (90)	75 (98.7)	8.3
	Yes	9 (23.7)	2 (2.4)	(2.5-60.8)**	5 (19.2)	1 (1.2)	(2.1-171.9)**	1 (10)	1 (1.3)	(0.5-145.1)
Total		38 (100)	82 (100)		26 (100)	81 (100)		10 (100)	76 (100)	

*Significant at <0.5, **Significant at <0.01. OR: Odds ratio, CI: Confidence interval, AFI: Amniotic fluid index, LSCS: Lower segment cesarean sections, SNCU: Sick newborn care unit, POG: Period of gestation

oligohydramnios by different forms of hydration therapy, such as oral versus parenteral.

CONCLUSION

Maternal hydration therapy might have a positive role to improve the fetomaternal outcome in pregnancies with oligohydramnios by preventing immediate preterm deliveries ensuring completion of antenatal steroids and reducing cesarean deliveries leading to better obstetric and neonatal outcomes. This simple intervention can be home based and assures universal health coverage, especially in resource-poor countries where the adverse perinatal outcome is a major issue.

Declaration of participant consent

The authors certify that they have obtained all appropriate participant consent forms. In the forms, participants gave their consent for sharing of data for academic publication. The participants understood that their names and other personal identifiers will be concealed, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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