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ORIGINAL ARTICLE

Effect of Maternal Intravenous Hydration in Management of Oligohydramnios and the Changes in the Fetal Doppler

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Abstract

Background: **Fetal health requires amniotic fluid. It supports fetal growth. Its dampening and bacteriostatic qualities cushion trauma and infection. Oligohydramnios is linked to premature rupture of membrane (PROM), fetal congenital malformations, intrauterine growth retardation (IUGR), postmaturity, hypertension, diabetes, autoimmune illnesses, hypovolemic syndromes, and iatrogenic conditions. Maternal plasma osmolality and hydration affect amniotic fluid content. Hydration lowers maternal plasma osmolality, increasing amniotic fluid. Mother's fluid balance affects amniotic fluid. Maternal fluid intake increases amniotic fluid index (AFI) with oligohydramnios. Maternal hydration improves amniotic fluid content in women with oligohydramnios, according to Doppler studies, because it promotes uteroplacental perfusion.**

Aim of the study: **To evaluate and assess the influence of intravenous hydration in pregnancies with third-trimester oligohydramnios on amniotic fluid index and on Doppler changes of uteroplacental blood flow.**

Patients and methods: **This was an interventional study, including 50 pregnant women in their third trimester who were diagnosed with oligohydramnios by ultrasonography and who visited the outpatient clinic at El Azhar University Hospitals.**

Results: **Maternal age (mean ± SD) was 30 ± 2.2836 and gestational age (wk) (mean ± SD) was 36 ± 0.544. Distinct differences existed among the groups based on amniotic fluid volume indices before and after the hydration procedure. There is no significance regarding the above parameters in the study groups.**

Conclusion: **Intravenous maternal hydration therapy was safe and effective in terms of improvement of amniotic fluid index in pregnant females with isolated oligohydramnios in the third trimester. Maternal intravenous hydration was found to enhance amniotic fluid volume and amniotic fluid index in females with oligohydramnios.**

Keywords: Amniotic fluid, Doppler ultrasound, Oligohydramnios

1. Introduction

Amniotic fluid has crucial functions for the growing fetus. It is an ideal setting for the growth and development of a fetus. Because of its dampening and bacteriostatic qualities, it acts as a cushion against shocks and infections. Fetal movement is encouraged, which aids in the growth of the skeleton and muscles. It protects the fetus from vascular and nutritional damage by preventing umbilical cord and placental compression.[1]

One of the most crucial measurements taken during fetal screening is the amount of amniotic fluid present in the uterus. When the volume of the amniotic fluid is less than 500 ml, the condition is called oligohydramnios, and when it is greater than 2000 Ml, the condition is called polyhydramnios.[2]

Phelan's definition of oligohydramnios called for an amniotic fluid index (AFI) of less than 5 cm or an SDP of less than 2 cm. Between 34 and 42 weeks of pregnancy, oligohydramnios affects 1–5% of pregnancies. High rates of postnatal morbidity and

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mortality as well as pregnancy difficulties have been linked to oligohydramnios.[3,4]

Premature membrane rupture, fetal abnormalities, intrauterine growth retardation, postmaturity, hypertension, diabetes, autoimmunity, hypovolemia, and iatrogenic causes are common causes of oligohydramnios. Almost 7 % of all cases of oligohydramnios are idiopathic. Around 4−5.5 % of all pregnancies experience complications due to this, and these complications are often connected with negative results for the fetus. In oligohydramnios, the perinatal morbidity and death rates may rise to 56.5 %. It also raises cesarean section (CS) rates by five to seven times. Furthermore, oligohydramnios is more likely in late-term pregnancies, as the AFV typically declines at term. It complicates up to 12 % of pregnancies that last longer than 41 weeks.[5]

Amniotic fluid (AF) volume is the sum of fluids entering the amniotic space (from fetal urine and lung fluid) and fluids leaving the amniotic space (from fetal swallowing and intramembranous absorption).[6]

The condition of maternal hydration and maternal plasma osmolality influences amniotic fluid volume. Ruptured membranes can cause acute oligohydramnios. Chronic oligohydramnios develops in the fetus as a result of persistent fluid leakage, prerenal, renal, and postrenal causes.[7]

Umbilical artery of the fetus Doppler velocimetry evaluates the downward resistance to blood flow in the umbilical arteries. Umbilical artery anomaly Doppler velocimetry is correlated with increased perinatal problems because it is a marker of fetal peripheral vasoconstriction.[8]

Doppler flowmetry of the umbilical artery in oligohydramnios revealed better sensitivity, specificity, and accuracy in diagnosing infant death when compared with assessing oligohydramnios and the Apgar score. Maternal hydration increases amniotic fluid volume in oligohydramnios patients by increasing uteroplacental perfusion, as evaluated by Doppler ultrasonography.[1]

2. Patients and methods

This was an interventional study on 50 pregnant women in their third trimester (from more than 32 weeks−37 weeks) who were diagnosed with oligohydramnios via ultrasound and attended the outpatient clinic at El Azhar University Hospitals. A prospective interventional study was carried out at Al-Azhar University's Department of Obstetrics and Gynecology, Faculty of Medicine, and its duration was from January 2022 to January 2023.

The Inclusion criteria were singleton pregnancy, viable fetus, gestational age greater than 32 weeks, AFI less than 5 cm, no cause for immediate delivery, and intact membranes.

The Exclusion criteria were patients with ruptured amniotic membranes, multiple pregnancies, post term pregnancy, maternal medical diseases (heart disease, renal disease, and moderate or severe preeclampsia), gestational age less than 32 weeks, intrauterine ful device (IUFD), fetal structural malformations, and vaso-bio-amino-carbon (VBAC).

2.1. Methods

All included cases were put through the following: complete history taking, clinical examination, maternal body mass index (BMI) was calculated, abdominal ultrasound examination, and intravenous hydration therapy.

The following was done at baseline and after intravenous hydration: amniotic fluid index evaluation, Doppler velocimetry (Doppler velocimetry for the umbilical artery and for uterine artery), hematocrit value (macrohematocrit and microhematocrit method), and urine analysis for specific gravity.

Evaluation of the pregnancy outcome as regards Apgar score at 1 and5 min, number of viable fetal births and stillbirth, gestation age at delivery by New Ballard Score, neonatal birth weight was measured using digital weight scale, admission to the NICU, and any maternal or fetal complication.

2.2. Sample size

This study was based on a study carried out by Hamed and colleagues 2023. Epi Info STATCALC was used to calculate the sample size by considering the following assumptions: 95 % two-sided confidence level, with a power of 80 % and α error of 5 %. The final maximum sample size taken from the Epi-Info output was 46. Thus, the sample size was increased to 50 patients to assume any dropout cases during follow-up.[9]

2.3. Ethical approval

After approval of the ethics committee, an official permission was obtained from the director and the head of Obstetrics and Gynecological Department at Al-Azhar University Hospitals, Egypt. Informed consent was obtained from the patients before enrollment of the study. All data were kept confidential and all participants had the right to withdraw from the study without affecting their management.

2.4. Statistical analysis

SPSS version 23 was used for data processing and was used to examine, enter, and analyze the data. The following statistical methods were utilized to analyze the current study's findings.

Data were expressed as a number and a percentage for qualitative factors and as a mean ± SD for quantitative variables.

3. Results

Table 1.

We conducted our study on 50 patients with maternal age, mean ± SD was 30 ± 2.2836 and gestational age (wk) (mean ± SD) was 36 ± 0.544 more over the number of nullipara cases that was 15 and multigravity was 29 (Table 2).

There is no significance regarding the above parameters in the study groups (Table 3).

The median prehydration AF parameters were 450 ml of AF volume and 8.6 AFI. Visible and quantifiable gains were seen in AF volume and AFI between measures given before and after IV hydration (*P*.001 for AF volume and AFI change).

4. Discussion

Amniotic fluid protects the fetus from harm and also allows for the development of the skeleton and muscles. It serves as a thermal regulator and provides some nutrition, albeit not much. Ingesting or inhaling amniotic fluid may stimulate development and differentiation of gastrointestinal and pulmonary tissues.[10]

With a prevalence of 2.3 %, oligohydramnios is one of the most common disorders endangering fetal health. Chronic fetal hypoxia, fetal growth limitation, recurrent preterm birth, and respiratory distress syndrome are all linked to oligohydramnios. Fetal malpresentation, compressed cord, meconium staining, increased perinatal mortality, and surgical deliveries may all result from this syndrome.[11]

Table 1. Maternal characteristics.

Characteristic	Median (range) or *n* (%)
Maternal age * (y)	26 (25–34)
Mean ± SD	30 ± 2.2836
Gravidity	
Primi/secondi	21 (42 %)
Multi	29 (58 %)
Parity	
Nulliparous	15 (30 %)
Parous	35 (70)
Gestational age (wk)*	35 (32–37)
Mean ± SD	35 ± 0.544

Table 2. Lab finding among the study population.

Variables	Summary statistic	*P* value
Pulse (bpm) (mean ± SD)	92 ± 17.9196	NS
Range (max–min)	(91–58)	
Mean ABP (mmHg) (mean ± SD)	90 ± 23.6561	NS
Range (max–min)	(54–148)	
Temperature (°C) (mean ± SD)	37 ± 1.0812	NS
Range (max–min)	(35–39)	
Hemoglobin (gm/dl) (mean ± SD)	11 ± 1.5524	NS
Range (max–min)	(7–15)	
Hematocrit (mean ± SD)	(32 ± 2.7698)	NS
Range (max–min)	(27–41)	
Birth weight (grams) (mean ± SD)	(39 ± 1.0134)	NS
Range (max–min)	(37–41)	

4.1. The main results of this study were as follows

Regarding the maternal characteristics among the studied group, it was found that the mean maternal age (mean ± SD) was 30 ± 2.2836 and gestational age (wk) (mean ± SD) was 36 ± 0.544 more over the number of nullipara cases that was 15 and multigravida was 29.

Intravenous hydration has no significant effect on pulse, mean arteria blood pressure (ABP), temperature, hemoglobin, hematocrit, and birth weight.

In a study comparing AF indices before and after hydration, the median prehydration AF indices were AF volume (450 ml) and AFI (8.6). By comparing the results from before and after IV hydration, both the AF volume and the AFI were observed to increase significantly (*P*.001).

According to the current study, Azarkish *et al.*[12] wanted to see how much of an impact I/V hydration had on the amniotic fluid index in cases of oligohydramnios. An overall sample size of 61 females (31 in the experimental group and 30 in the placebo group) participated in the research.

Table 3. Amniotic fluid volume indicators before and after hydration.

	Pre hydration	Post hydration	*P**
AF volume	450 (395–670)	700 (583–872)	0.001
Change in AF volume		188 (60–277)	
Change (%)		41 (11–62)	
AFI	8.6 (7.2–11.1)	10.1 (8.5–17.7)	0.001
Change in AFI		1.7 (0.9–3.3)	
Change (%)		24 (11–27)	

Age, BMI, parity, gestational age, incidence of cesarean section, and birth weight of neonates were all comparable across the two groups. There were no reported shifts in blood pressure despite significant fluid intake. It was found in the study that there were no statistically significant variations in the mean AFI between the intervention and control groups before the introduction of maternal intravenous hydration ($P = 0.128$). The mean AFI was significantly different between the groups 48 h after fluid therapy was stopped. In conclusion, it was found that AFI in women with oligohydramnios is greatly improved after intravenous hydration of the mother.

Habib *et al*.[13] evaluated the results of intravenous hydration and amino acid infusion for the treatment of isolated oligohydramnios, finding that the latter was more effective. About 104 pregnant women with isolated oligohydramnios participated in the study, and half were given a saline infusion (group A), while the other half were given an amino acid infusion (group B). In group A versus group B, the mean maternal age was 32.1 ± 4.4 versus 31.0 ± 5.5 years, mean gestational age was 29.1 ± 2.9 versus 29.0 ± 3.1 wks, and mean BMI was 34.6 ± 9.7. Multigravida was the norm in both sample groups. The initial mean AFI was similar between the two groups (3.78 ± 0.56 vs. 3.73 ± 0.36). By comparing groups A and B, group B had a significantly higher mean AFI after six infusions (4.79 ± 0.65 vs. 6.82 ± 0.62). Group B also had a significantly higher increase in AFI over group A (1.0 ± 031 vs. 3.09 ± 0.70). Therefore, they reasoned intravenous amino acid treatment is useful in the management of isolated oligohydramnios and is effective at reducing AFI.

Malik *et al*.[14] confirmed our findings by investigating the impact of oral and intravenous fluids on the frequency with which oligohydramnios improved in the third trimester of pregnancy. The study involved 100 singleton pregnancy patients (50 in each group). The average age of the individuals in the oral and intravenous groups was 33.62 ± 5.45 years and 34.70 ± 4.76 years, respectively. Improvement was seen in 39 (78 %) of the oral group and 22 (44 %) of the intravenous group. Prehydration mean amniotic fluid index levels were 4.79 ± 0.53 in the oral group and 4.87 ± 0.36 in the intravenous group. The mean amniotic fluid index level after hydration was 6.79 ± 1.22 and 5.97 ± 1.37 in the oral and intravenous groups, respectively. So they concluded that oral hydration of pregnant women is more beneficial than intravenous hydration.

Also, Deshmukh *et al*.[15] performed a comparison of oral and intravenous hydration therapy on maternal and fetal outcome in oligohydramnios patients. The study enrolled 180 patients that received oral hydration. About 120 patients received IV hydration therapy. Both groups were well-matched as regards baseline data. Patients receiving oral hydration therapy had a mean AFI on admission of 4.86 cm, while those receiving intravenous hydration therapy had a mean AFI of 5.11 cm. The mean AFI in the oral and IV groups, 48 h after hydration, was 6.02 and 5.70 cm, respectively. Researchers found that patients with oligohydramnios benefited from both oral and intravenous hydration therapies. A comparison of two treatments reveals no statistically significant differences in mother and fetal outcome. Yet, in cases of low AFI and oligohydramnios, a simple, effective, cost-free, side-effect-free, readily available method of hydration therapy can serve as both a therapeutic and preventative purpose.

Furthermore, Khajotia *et al*.[16] aimed to determine the effects of hydration therapy on patients with oligohydramnios. The study enrolled 200 women, equally assigned to receive oral or intravenous hydration. All baseline data were well-matched between the studied groups. The mean AFI in the intravenous group was 4.47 ± 0.90 cm before hydration therapy and 7.16 ± 1.57 cm after hydration therapy, representing a 60.18 % rise; in the oral group, the figures were 4.52 ± 0.83 cm before hydration therapy and 7.48 ± 1.56 cm after hydration therapy, representing a 65.48 % increase. When the two groups are compared, however, the increases in mean AFI were not significant ($P > 0.05$).

Furthermore, Rehan and Nagina[17] sought to ascertain the percentage rise in mean amniotic fluid index in pregnant women following I/V maternal hydration in third-trimester oligohydramnios. There were 156 women with oligohydramnios in their third trimester who participated in the trial. Researchers found that cases of oligohydramnios saw an increase in amniotic fluid volume when mothers were given intravenous hydration. (mean difference in AFI 2.9 cm, 95 % CI). The typical increase in AFI was 87 % ± 33.5.

Our results also jived with those of Sharmila,[18] who aimed to assess the effectiveness of I/V maternal hydration therapy in the management of third-trimester oligohydramnios and its impact on infant outcome. Patients with oligohydramnios in their third trimester of pregnancy (150) were compared with individuals without condition (150) in the intravenous hydration group. After treatment, the AFI was considerably greater in the study group. The perinatal result of the hydration therapy group and the control group did not differ significantly.

4.2. Conclusion

In the third trimester, intravenous maternal hydration therapy was found to be safe and helpful in increasing amniotic fluid index in pregnant cases with isolated oligohydramnios. The results showed that women with oligohydramnios whose amniotic fluid volume or amniotic fluid index was low had these parameters dramatically improved after receiving maternal intravenous hydration. Our findings need to be confirmed in larger studies with longer follow-up periods so that risk factors for negative outcomes may be identified.

Authorship

All authors have a substantial contribution to the article.

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

Conflicts of interest

The authors declared that there were no conflicts of interest.

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