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Comparison of Oral versus Intravenous Fluid Therapy on Amniotic Fluid Index in Women with Oligohydramnios

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ABSTRACT

Oligohydramnios, characterized by reduced amniotic fluid volume, poses significant risks to fetal growth and pregnancy outcomes. **Objectives:** To compare the effects of oral versus intravenous fluid therapy on AFI in women with oligohydramnios, and to determine the more effective hydration strategy for clinical use. **Methods:** Following ethical approval from the Institutional Review Board of Fatima Jinnah Medical University, a quasi-experimental study was conducted. 60 patients diagnosed with oligohydramnios based on operational criteria were enrolled after obtaining written informed consent. Participants were randomly divided into two groups: Group A received IV hydration, while Group B received oral hydration. Both groups remained admitted for one week, during which AFI was measured at baseline and after the intervention. **Results:** The mean age of participants was 27.67 ± 6.00 years. Baseline AFI was 3.79 ± 0.25 cm, with no significant differences between groups. After one week, Group A (IV hydration) showed a mean AFI of 5.34 ± 0.23 cm, while Group B (oral hydration) achieved a significantly higher mean AFI of 5.69 ± 0.41 cm (p=0.000). Treatment efficacy was reported in 90.0% of Group A and 96.7% of Group B participants (p=0.612). **Conclusions:** The improvement in AFI with oral hydration was slightly better than with IV hydration, but not statistically significant. The two interventions were safe with no maternal or fetal adverse effects. The first option is oral hydration, which is practical, non-invasive, and cost-effective, especially in resource-restricted settings.

INTRODUCTION

The volume of amniotic fluid is a basic indicator of the intrauterine fetal health and a prerequisite for proper fetal growth and development. The amniotic fluid index (AFI) is an ultrasonography method that is deemed normal with a 5-25 cm range [1]. Oligohydramnios is an AFI lower than 5 cm, which is a condition that is linked to severe adverse neonatal outcomes, such as umbilical cord compression, pulmonary hypoplasia, and fetal distress, as well as a higher risk of intrauterine fetal demise, especially when not detected early or that is sustained [2]. In turn, oligohydramnios is still a major cause of perinatal morbidity and mortality in various healthcare establishments. Population prevalence data on a large scale offer clinical relevance of this condition. The First Look Trial, which included more than 13,000 third-trimester pregnancies in Guatemala, Zambia, Pakistan, and the Democratic Republic of Congo, reported oligohydramnios in an average of one in every 150 pregnancies, highlighting the worldwide incidence of the condition, even in low- and middle-income nations [3]. Such prevalence requires not only clinical but also practical approaches in the framework of common obstetric care management strategies. Different invasive interventions that are being used to improve AFI, including desmopressin, intra-amniotic sealing, transabdominal amnioinfusion, and fetal cystoscopy, have been outlined [4, 5]. These methods are, however, expensive, need special

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skills and long-term hospital care, and can potentially cause fetal risks. Their accessibility and practicality are limited and cannot be used widely, particularly in a resource-strained environment. Maternal hydration has thus been considered as a non-invasive, non-surgical, and low-cost treatment for isolated oligohydramnios. The physiological basis of maternal hydration is that depletion of maternal plasma osmolality maximizes uteroplacental perfusion and fetal renal perfusion, leading to increased fetal urine production and consequent increase in amniotic fluid volume [6, 7]. Due to the close connection between maternal fluid balance and AFI, a number of studies have reported the positive response of AFI to the increased maternal fluid intake [8]. The hydration of the mother can be done either orally or by an intravenous route. Oral hydration usually implies the higher intake of plain water, whereas intravenous hydration involves the use of isotonic or hypotonic fluids like normal saline, Ringer's lactate, or dextrose-containing fluids [9]. Although oral hydration has the benefit of being cheaper, preventing hospitalization, and being more comfortable to the patient, intravenous hydration remains a common practice in most obstetric units [10]. There is still an inconsistency in evidence comparing the efficacy of oral and intravenous hydration. Though there have been studies that have yielded better results in improvement of AFI by oral hydration, others have indicated similar results with the two modalities [11-13]. These contradictions also indicate a significant evidence gap in terms of the best course of maternal hydration, especially in environments where resource allocation, hospital bed space, and cost-effectiveness form a key factor in consideration. Considering the broad application of intravenous hydration despite its logistical drawbacks and the discordant information on the comparative efficacy of oral hydration, an explicit and systematic comparison between the two strategies is clinically justified.

This study aimed to compare the changes in amniotic fluid index between oral and intravenous fluids in cases of oligohydramnios during pregnancy, as measured at baseline and after one week of treatment, and the mean change in AFI in the two groups.

METHODS

This quasi-experimental study was carried out at the Department of Obstetrics and Gynecology, Sir Ganga Ram Hospital, Lahore. The study duration was from November 2024 to January 2025. Ethical approval was taken from the Institutional Review Board of Fatima Jinnah Medical University, Lahore, with ref no: 170-MS-Gynaecology/IRB-ERC. The sample size was calculated using mean AFI levels of 5.3 ± 0.7 and 4.8 ± 0.6 for oral and IV hydration groups, respectively, by taking a 95% confidence interval and 80% power of test, and a 20% dropout rate. For better generalization, the final sample size was increased to 60 patients, with 30 participants in each group (sample size calculated using Open Epi: https://www.openepi.com/SampleSize/SSMean.htm) [14]. A convenient sampling technique was used to enroll the patients. Eligible participants were women aged 16–40 years, with parity <5, gestational age between 32 and 35 weeks (LMP-based), intact membranes, and singleton pregnancies. Women with congenital anomalies, IUGR, hypertension, diabetes, anemia, liver or renal dysfunction, cardiac disease, placental abruption, placenta previa, or a history of similar complications were excluded. Following the ethical approval and written informed consent, this quasi-experimental study recruited 60 pregnant women with oligohydramnios. The subjects were randomized to two intervention groups (sequentially) with a predetermined alternate method of allocation, i.e., the first 30 patients were given oral hydration (Group A), and the next 30 patients were given intravenous hydration (Group B). Group A was treated by IV hydration of 2 L every four hours for one week with Isotonic saline. For group B, the study switched to oral hydration at the same volume and rate. Recruits had to undergo a set of baseline tests for blood sodium, potassium, and chloride to ascertain the baseline level of serum compartment hydration, and then remained confined. All participants had to stay in the hospital for one week to ensure to confirm compliance directly by collecting urine to test osmolality. Participants also had blood drawn for serum urea and electrolytes on alternating days. Signs/ symptoms of overhydration were watched for. The over-hydrated patients had their AFI levels (amniotic fluid index) measured at the end of the week by the same person multiple times from the group. Standard IV treatment was given to those oral group patients by day 3 who had not measured a viable AFI. Among pregnant patients, the effect of treatment was determined as an AFI change following hydration treatment. US assessed AFI at enrollment (before hydration) and at one-week follow-up. AFI change was calculated (in centimeters) by calculating the difference between baseline and follow-up. Effective treatment was considered to be one where the clinical improvement was significant, i.e., an AFI over 5 cm within one week after the treatment was taken. The same trained sonographer measured the primary outcome of AFI for all participants in order to have consistency and to minimize inter-observer variations. Since this was a quasi-experimental study, blinding was not applied; this was aided by using just one sonographer so that the chances of measurement bias were minimized. The participants provided a signed informed consent to allow the researchers to analyze the data with the SPSS version 26.0 analysis program under the provided conditions. For the

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quantitative variables of the participants (age, primary BMI, number of live children, duration of pregnancy in weeks, number of AFI levels), which were provided by SD, the normality of data was assessed by using the Shapiro-Wilk test, and after assessing normality, the independent sample t-test and the paired sample t-test were applied. Chi-square/Fisher's exact test was applied to see the association of study groups and study outcomes. The criteria for p-values to allow significant features were 0.05 or weaker statistically. The results for AFI also had to be stratified relative to their BMI, age, weeks of gestation for and number of children to show any modifier effects.

RESULTS

A total of 60 women diagnosed with oligohydramnios were enrolled and divided equally into two groups: Group A (IV hydration) and Group B (oral hydration). The baseline characteristics of both groups were statistically the same. Group A had a mean age of 28.27 ± 5.82 years while Group B had a mean age of 27.07 ± 6.23 years (p=0.444). The mean gestational ages were 34.40 ± 1.61 and 34.63 ± 1.69 weeks (p=0.586). The groups also had no statistically significant differences in parity (2.30 ± 1.09 vs. 2.17 ± 1.02; p=0.626), and BMI (26.04 ± 3.59 vs. 25.82 ± 3.83; p=0.816). The mean AFI at time of admission to both groups was also very similar (3.77 ± 0.25 cm vs. 3.81 ± 0.25 cm; p=0.575), supporting the idea that they were the same at baseline (Table 1).

Table 1: Comparison of Baseline Characteristics Between the Groups

Characteristics	Group A (n=30)	Group B (n=30)	p-value
Age			
16–40 Years	28.27 ± 5.82	27.07 ± 6.23	0.444 *
16–30 Years	18 (60.0%)	19 (63.3%)	0.791 **
31–40 Years	12 (40.0%)	11 (36.7%)	–
Gestational Age	34.40 ± 1.61	34.63 ± 1.69	0.586 *
Weeks			
32–35 Weeks	19 (63.3%)	17 (56.7%)	0.598 **
36–37 Weeks	11 (36.7%)	13 (43.3%)	–
Parity			
–	2.30 ± 1.09	2.17 ± 1.02	0.626 *
1–2	19 (63.3%)	20 (66.7%)	0.787 **
3–4	11 (36.7%)	10 (33.3%)	–
BMI			
kg/m^2	26.04 ± 3.59	25.82 ± 3.83	0.816 *
Normal Weight	11 (36.7%)	15 (50.0%)	0.297 **
Overweight/Obese	19 (63.3%)	15 (50.0%)	–
AFI (cm)			
At Admission	3.77 ± 0.25	3.81 ± 0.25	0.575 *

*Independent sample t-test. ** Chi-Square test. Taking p-value≤0.05 as significant.

In both groups, AFI improved in the week that followed. Group A was 5.34 ± 0.23, and Group B was 5.69 ± 0.41 cm. The difference between groups was statistically significant (p=0.000). The mean change in AFI from baseline to post-intervention (after 1 week) was 1.56 ± 0.34 cm in Group A and 1.88 ± 0.39 cm in Group B (p=0.001), showing that more improvement was seen with oral hydration (Table 2).

Table 2: Comparison of Mean Change in AFI Level Between the Study Groups

Time Interval	Study Groups	n	Mean ± SD	p-value
At Admission	Group A	30	3.77 ± 0.25	0.575
	Group B	30	3.81 ± 0.25	–
Post Intervention After 1 Week	Group A	30	5.34 ± 0.23	0.000
	Group B	30	5.69 ± 0.41	–
Change in AFI	Group A	30	1.56 ± 0.34	0.001
	Group B	30	1.88 ± 0.39	–

Independent sample t-test, taking p-value≤0.05 as significant.

Within-group analysis showed that all groups demonstrated significant growth in AFI with treatment. Group A showed AFI from 3.77 ± 0.25 cm to 5.34 ± 0.23 cm (p<0.001), while Group B showed AFI from 3.81 ± 0.25 cm to 5.69 ± 0.41 cm (p<0.001) with respect to study results (Table 3).

Table 3: Comparison of Mean AFI Level from Baseline within the Groups after Treatment

Study Groups		Mean	p-value
Group A (Pair 1)	AFI at After 1 Week: 5.337	0.23 ± 1.43	0.000
	AFI at Admission: 3.773	0.25 ± 1.43	
Group B (Pair 1)	AFI at After 1 Week: 5.693	0.41 ± 1.73	0.000
	AFI at Admission: 3.810	0.25 ± 1.73	

Treatment success was observed in 27 (90.0%) of participants in Group A and in 96.7% (n = 29) of Group B, with neither group showing a significant difference (p=0.612). There were no cases of fluid overload in Group A, while one case (3.3%) was observed in Group B (p=1.000). There were no incidents of treatment failure in either group, with both methods having good tolerability (Table 4).

Table 4: Comparison of Various Study Outcomes Between the Groups

Characteristics	Yes / No	Group A (n=30)	Group B (n=30)	p-value
Efficacy Achieved	Yes	27 (90.0%)	29 (96.7%)	0.612
	No	3 (10.0%)	1 (3.3%)	–
Fluid Overload	Yes	0 (0.0%)	1 (3.3%)	1.000
	No	30 (100.0%)	29 (96.7%)	–
Treatment Failure	Yes	0 (0.0%)	0 (0.0%)	–
	No	30 (100.0%)	30 (100.0%)	–

In stratified analysis, oral hydration (Group B) had the highest mean AFI at Week 1 across all subgroups: age, gestational age, parity, and BMI. Among 16-30 years (p=0.001), 31-40 years (p=0.042), those with gestational age 32-35 weeks (p=0.000), parity 1-2 (p=0.001), and both normal weight (p=0.009) and overweight/obese (p=0.007)

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women, the differences were statistically significant. Although the trends aligned with oral hydration in other subgroups, the differences were not statistically significant, likely due to sample size (Table 5).

Table 5: Comparison of Mean AFI at Week 1 Between the Groups Stratified for Age, Gestational Age, Parity, and BMI

Variables	Subgroups	Study Groups	n	Mean ± SD	p-value
Age	16–30 Years	Group A	18	5.39 ± 0.16	0.001
		Group B	19	5.73 ± 0.35	–
	31–40 Years	Group A	12	5.25 ± 0.29	0.042
		Group B	11	5.63 ± 0.52	–
Gestational Age	32–35 Weeks	Group A	19	5.36 ± 0.22	0.000
		Group B	17	5.80 ± 0.37	–
	36–37 Weeks	Group A	11	5.30 ± 0.24	0.102
		Group B	13	5.55 ± 0.44	–
Parity	1–2	Group A	19	5.34 ± 0.23	0.001
		Group B	20	5.72 ± 0.38	–
	3–4	Group A	11	5.33 ± 0.23	0.073
		Group B	10	5.64 ± 0.49	–
BMI	Normal Weight	Group A	11	5.29 ± 0.24	0.009
		Group B	15	5.71 ± 0.44	–
	Overweight/ Obese	Group A	19	5.36 ± 0.22	0.007
		Group B	15	5.68 ± 0.41	–

DISCUSSION

Oligohydramnios, which is characterized by a low amniotic fluid index (AFI), correlates with higher chances of undesirable maternal and fetal events, such as premature delivery, intrauterine growth retardation, and neonatal morbidity. Maternal hydration is a non-invasive measure of optimization of AFI that can be successfully researched. There is both oral and intravenous (IV) fluid supplementation that finds use in clinical practice, but comparative efficacy is a subject of research. This quasi-experimental research paper was designed to investigate the efficacy of oral and IV hydration in enhancing AFI in patients with isolated oligohydramnios and the goal of optimal maternal and fetal outcomes [15]. A total of 60 participants were involved in this investigation, and the mean maternal age was 27.67 + 6.00 years, which is similar to previous studies that show between 26.2 and 26.68 years, although some groups showed maternal ages of 32.2 ± 39.44 years. The average gestational age was 34.52 and was 1.64, and the mean parity was 2.23 and mean BMI was 25.93 and 3.69 kg/m2 as previously reported [13, 16]. AFI was 3.79 +/ -0.25 cm, which agrees with the reported ranges of oligohydramnios (3.3-4.8 cm). After a week of intervention, there was an increase in AFI of 5.34 ± 0.23 cm in the IV hydration group (Group A) and 5.69 ± 0.41 cm in the oral hydration group (Group B), but the difference between the two groups was statistically significant ($p<0.001$). The average change in AFI was 1.56 ± 0.34 cm when hydrated with IV and 1.88 + 0.39 cm when hydrated with oral fluid, which was better with oral fluid. Such findings are in agreement with previous reports, which have noted higher levels of post-intervention AFI in patients who are administered oral hydration [17, 18]. The results of the current research are supported by a systematic review and meta-analysis. The available evidence demonstrates that oral hydration therapy is a promising intervention to improve the amniotic fluid index (AFI) and is a safe and cost-effective intervention to treat oligohydramnios. It is specifically beneficial in contexts with limited resources as its administration is relatively simple, and the intravenous therapy may be limited in accessibility to the hospital. These results support the validity of oral hydration as a primary intervention in the prevention of AFI and the enhancement of maternal and fetal outcomes [19]. Physiological reasons could be used to explain the relatively increased effectiveness of oral hydration. An oral fluid intake activates gastrointestinal absorption and could influence a more gradual and prolonged plasma volume expansion, which stimulates renal perfusion and fetal urine production, a key factor in amniotic fluid volume. On the other hand, IV hydration causes a more acute and temporary intravascular volume increase, which can be temporary and less efficient in the maintenance of long-term increases in AFI [1]. Although in our study, the overall treatment efficacy was slightly better in the oral hydration group (96.7% versus IV hydration 90.0%), the difference was not statistically significant ($p=0.612$). Notably, fluid overload and other unfavorable maternal/fetal outcomes were not observed in any of the participants, which demonstrates the safety of both types of hydration. These data are in line with the previous studies on comparing oral and intravenous maternal hydration in third-trimester oligohydramnios [20]. The shortcomings are that the study has a single-center design, and the sample is small, which could limit the generalizability. Finally, oral and IV hydration strategies are safe and effective in the treatment of AFI in isolated oligohydramnios, with better effectiveness of the first probably due to a prolonged plasma volume expansion and increased fetal urine. The findings offer clinically applicable information on the choice of hydration strategies to attain the best perinatal outcomes.

CONCLUSIONS

Oral and intravenous hydration are safe and effective interventions to improve the amniotic fluid index (AFI) of women with oligohydramnios. Even though oral hydration was found to increase AFI slightly better than IV hydration, this difference was found to be not significant. Both methods were safe, as no negative effects were found on a maternal or fetal level. Oral hydration is non-invasive, cost-effective, and can be implemented easily, and can, therefore, be regarded as a practical first-line strategy,

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especially in resource-limited environments.

Authors Contribution

Conceptualization: MS
Methodology: ST
Formal analysis: MF
Writing review and editing: MS

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

All the authors declare no conflict of interest.

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