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Original Research Article

Effects of intravenous hydration with hypotonic saline in oligohydramnios

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ABSTRACT

Background: The amniotic fluid encloses and protects the fetus within the amniotic cavity in uterus. Amniotic fluid allows room for fetal growth, movement and development. The abnormal amniotic fluid either high or low volumes helps to diagnose the reduced fetal outcomes. This fluid is an important predictive tool for assessing the development of pregnancy.

Methods: The present study is done to assess the effectiveness of intravenous (IV) hypotonic saline fluid maternal hydration on oligohydramnios. This study was conducted in department of obstetrics and gynecology, CHRI for 18 months. About 30 participants of third trimester with amniotic fluid index (AFI) < 8 cm with the gestational age of 34-40 weeks were included. The study was done on pregnant mothers with AFI < 8 cm and gestational age of 34-40 weeks. Measurement of AFI was done for all participants. The patients received 2 liters of hypotonic saline fluid over 4 hours. AFI was measured again 24 hours after baseline measurement. Treatment with IV infusion of hypotonic saline fluid is resulted in better increase in AFI in oligohydramnios.

Results: After hypotonic saline infusion, the patient's AFI level was 7.14 ± 1.31 with the $p=0.000^{***}$ and it was statistically significant.

Conclusions: The blood parameters and the electrolytes showed no notable changes before and after the infusion of hypotonic saline with regular antenatal visits, oligohydramnios can be detected early by clinical examination and routine ultrasonography and the proper treatment will help in preventing the complications of oligohydramnios.

Keywords: Oligohydramnios, AFI, Hypotonic saline, Amniotic fluid

INTRODUCTION

Amniotic fluid provides protective cushion for the fetus and keeps the temperature of the fetus stable, and prevents attachment to the fetal membranes. The amniotic fluid also helps the movement of fetus and symmetrical growth of the fetus.¹ The reduced volume of amniotic fluid results in a condition called oligohydramnios that affects about 1-5% of the pregnancies. The reduction in amniotic fluid may be due to the fetus growth disorders, urinary tract obstruction or renal agenesis, chronic leaks from gaps in the fetal membranes, and in 15-25% of cases fetal abnormalities.² Oligohydramnios affects the result of

pregnancy and fetal health. In some conditions, it may reduce to a few milliliters of viscous fluid which results in an increase in fetal death to 40-50 times of the rates among normal pregnancies.³

The maternal blood volume is important role in regulating the amniotic fluid volume.⁴ Hydration status and maternal plasma osmolality can also alter amniotic fluid volume.^{5,6} Few studies found that the oral hydration increases the amount of amniotic fluid in women with oligohydramnios, but there was no significant increase in women with normal amniotic fluid volume.⁷

AFI is more sensitive indicator of amniotic fluid volume throughout the pregnancy. It is calculation of largest vertical height of largest pool in every quadrant (note slim “silvers” of fluid, i.e., <1 cm wide, should not be measured). AFI varies with gestational age, measurement below 2.5% or above 97.5% are significant.

Doi et al noted a significant increase in the AFI in oligohydramnios pregnant women above 35 weeks of gestation with oral hydration as well as IV injection of hypotonic solutions but no elevated AFI was noted with injection of isotonic solutions.⁶

Several studies showed that there was an increase in AFI with maternal hydration in normal pregnancies and in pregnancies with oligohydramnios. Shahnazi et al reported an increase in AFI (from 4.70 to 6.25 cm) after hydration with one liter of isotonic saline infusion.⁸ Several studies on the effects of maternal hydration on AFI have had different results.⁹

Hence, we conducted a study to find out the effects of IV hydration with hypotonic saline on AFI in oligohydramnios.

METHODS

Study type

It was a longitudinal cohort study.

Study place

Study conducted at department of obstetrics and gynecology, Chettinad hospital and research institute.

Study period

Study carried out for 18 months from November 2022 to April 2023.

Inclusion criteria

About 30 participants of third trimester with AFI<8 cm with the gestational age of 34-40 weeks were included.

A detailed history was taken regarding age, parity, gestational age, menstrual history, obstetric history and comorbidities in present pregnancy, history of premature rupture of membranes. The patient was informed about my

study and consent was taken. All the patients received 2 liter of hypotonic saline (0.45% saline) over 4 hours.

General clinical examination was done. Pulse rate, blood pressure, temperature, height of patient and weight of the patient were noted. Symphysis fundal height and adequacy of amniotic fluid were clinically noted. Fetal heart rate was counted. Speculum, examination was done to rule out draining ply and confirmed the presence of the membranes.

All routine investigations done. AFI was measured by the technique described by Phelan et al. Measurement of AFI was done for all participants. AFI was measured again 24 hours after baseline measurement. The exclusion criteria of this study were multiple pregnancy, membranes absent (PROM), PIH, GDM, fetal distress, anaemia, and spontaneous progression of labour. Institutional ethical committee approval will be obtained before starting the study.

Statistical analysis

Student paired t test was used to find out the mean difference before and after the treatment. $P<0.05$ will be considered as statistically significant. Data will be analysed by using SPSS software version-16.

RESULTS

Inter group comparison of AFI before and after infusion of hypotonic saline in the oligohydramnios before hypotonic saline infusion group, AFI level was 6.10 ± 0.791 and after hypotonic saline infusion group, the AFI level was 7.14 ± 1.31 with the $p=0.000^{***}$ and it was statistically significant.

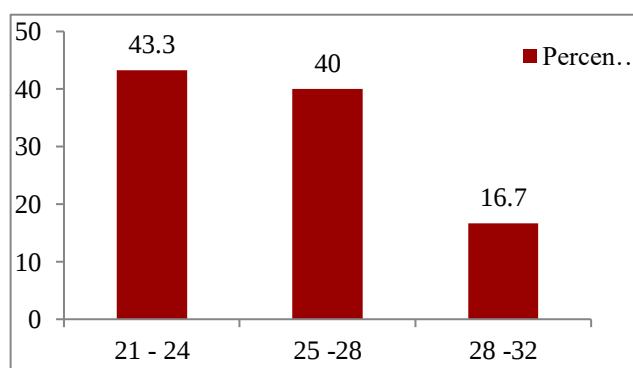


Figure 1: Frequency distribution of age in this study.

Table 1: Comparison of AFI before and after infusion of hypotonic saline in the oligohydramnios subject by using paired student t test.

Parameters	Before hypotonic saline infusion group, mean $\pm$ SD, n=30	After hypotonic saline infusion group, mean $\pm$ SD, n=30	Mean difference	t value	P value
AFI level	6.10 $\pm$ 0.791	7.14 $\pm$ 1.31	-1.06	-5.005	0.000*** (NS)

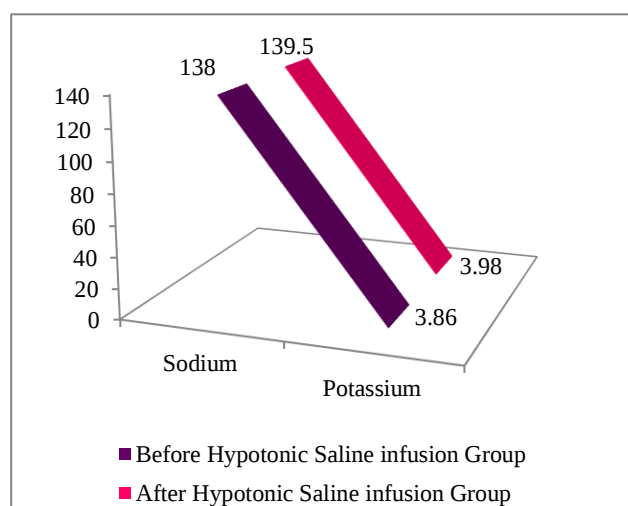
*Data are described as mean $\pm$ SD values of both groups *** $p<0.01$ -* $p<0.05$ (alpha value)-statistically significant, ns-not significant.

Table 2: Inter group comparison of blood urea nitrogen and creatinine before and after infusion of hypotonic saline in the oligohydramnios subject by using paired student t test.

Blood parameters	Before hypotonic saline infusion group, mean±SD, n=30	After hypotonic saline infusion group, mean±SD, n=30	Mean difference	t value	P value
Blood urea nitrogen	5.76±1.75	5.74±1.13	0.021	0.95	0.925 (NS)
Creatinine	0.593±0.08	0.663±0.37	0.66	-1.002	0.324 (NS)

*Data are described as mean±SD values of both groups. ***p<0.01-*p<0.05 (alpha value)-statistically significant, ns-not significant.

Inter group comparison of blood urea nitrogen and creatinine before and after infusion of hypotonic saline in the oligohydramnios before hypotonic saline infusion group, blood urea nitrogen level was 5.76±1.75 and after hypotonic saline infusion group, the blood urea nitrogen value was 5.74±1.13 with the p=0.925 and it was statistically not significant. In before hypotonic saline infusion group, creatinine level was 0.593±0.08 and after hypotonic saline infusion group, the creatinine value was 0.663±0.37 with the p=0.324 and it was statistically not significant.

**Figure 2: Inter group comparison of electrolytes before and after infusion of hypotonic saline in the oligohydramnios subject.**

Inter group comparison of electrolytes before and after infusion of hypotonic saline in the oligohydramnios before hypotonic saline infusion group, sodium level was 138.00±3.64 and after hypotonic saline infusion group, sodium value was 139.50±3.13 with p=0.010** and it was statistically significant. In before hypotonic saline infusion group, potassium level 3.860±0.368 and after hypotonic saline infusion group, potassium value was 3.98±0.43 with p=0.025** and it was statistically significant.

DISCUSSION

The present study showed that the IV maternal hydration on oligohydramnios causes a significant raise in the AFI. The raise in AFI may be due to amniotic volume changes

and maternal plasma osmolality. The normal value of amniotic fluid is an indicator of normal fetus. Amniotic fluid volume decrease during pregnancies without the premature membranes rupture will cause a stress to the fetus with shunt blood to heart, brain and left from another organs including kidneys.¹⁰ The reduced renal perfusion causes decreased urine out of fetus and result in oligohydramnios. Thus, amniotic fluid volume assessment is an essential tool in formative the women at risk in antenatal period.

In this present study, we found that the mean AFI before infusion of hypotonic saline was about 6.10±0.791 and after infusion the AFI level was 7.14±1.31 with the p=0.000*** and it was statistically significant.

Shinde et al found that the mean AFI at admission was observed as 4.22±2.00 cm. The mean AFI on the 14th day in the in the IV hydration group was about 5.89±2.20 with a significant p<0.0001.¹¹

Doi et al found that hydration of mothers altered the osmolality and hence increased amniotic fluid volume more than blood volume.¹² On the other hand, Flack et al showed that hydration of mothers reduced plasma osmolality and urine. Moreover, AFI increased in the oligohydramnios group. The mean change of AFI was 3.2 cm, and the uterine artery blood flow velocity significantly increased.¹³

The researchers found that the increase in AFI may be due to increased uterine placental perfusion. Kilpatrick and Safford noted significant raise in the mean arterial flow velocity after hydration of mothers. They proposed that hydration may increase AFI by improving placental blood flow.¹⁴

In the present study we also noted no changes in the blood parameters and electrolytes before and after the infusion of volume of hypotonic saline.

CONCLUSION

The complications of reduced amniotic fluid cause deleterious effects on the mother and the fetus. Hence, hydration of mother with low-cost treatment methods with no complications for both is needed. In our study we found that there is increase in AFI after IV infusion of volume of

hypotonic saline in oligohydramnios. Maternal hydration with hypotonic saline fluid produces osmotic change, which simultaneously reduced fetal osmolality, increased fetal urine flow and formation of amniotic fluid.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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