

# Mean Increase in Amniotic Fluid Index in Pregnant Women after Intravenous Maternal Hydration in 3<sup>rd</sup> Trimester Oligohydramnios

SABA REHAN, NAGINA

## ABSTRACT

**Aim:** To determine percentage increase in mean amniotic fluid index in pregnant women after intravenous maternal hydration in 3<sup>rd</sup> trimester oligohydramnios.

**Methodology:** One fifty six women with third trimester oligohydramnios (AFI <5cm) were prospectively recruited for this study. Study inclusion criteria were gestational age from 28wks to 40wks(determined from LMP), singleton pregnancy, Age from 18years to 35years, parity upto gravida 5, Intact membranes, absence of cardiac and renal impairment, absence of preeclampsia, absence of diabetes mellitus, absence of fetal congenital anomalies, absence of significant hemorrhages and acute febrile illness. Maternal amniotic fluid index was determined before and after intravenous hydration by infusing 2 litres of 5% dextrose water in 2 hrs and recorded on predesigned proforma.

**Results:** Maternal hydration increased amniotic fluid volume in cases with oligohydramnios. (Mean change in AFI 2.9cm, 95% confidence interval ; p-value <0.001). The mean percentage increase in AFI was 87%±33.5

**Conclusion:** Under the condition of this study, maternal intravenous hydration significantly increased the AFV in women with third trimester oligohydramnios which may be beneficial in management of oligohydramnios and continuation of the pregnancy upto term without any complication.

**Keywords:** Maternal hydration. Oligohydramnios. Amniotic fluid volume.

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## INTRODUCTION

Oligohydramnios occurs in about 8 out of 100 pregnancies and commonly recorded in the last trimester of pregnancy. It is estimated to be 12% of pregnancies of 41 weeks or greater<sup>1,2</sup>. The important causes of oligohydramnios include Fetal; chromosomal defects, congenital factors, IUGR, post term pregnancies, fetal demise<sup>1</sup>, Maternal; dehydration, hypertension, pre-eclampsia, diabetes, uteroplacental insufficiently<sup>1</sup>, Drugs; indomethacin, ACE inhibitors and Idiopathic (Isolated Oligohydramnios)<sup>3</sup>.

This obstetric complication is associated with intrauterine growth restriction (IUGR), congenital malformations, an increased risk of fetal distress, Intrauterine death (IUD), small for gestational age, a high rate of surgical delivery, impairment of fetal pulmonary development, and meconium aspiration.<sup>3</sup>

In mid gestation fetal urine begins to enter the amniotic sac and the fetus starts to swallow the amniotic fluid secretion from the fetal lungs also added into AFV smaller contribution may occur across the fetal skin, ceases with keratinization at 22 to 24 weeks of gestation. In late gestation amniotic fluid is produced by fetal urine and fetal lung liquid and clearance is by the fetal swallowing.

Amniotic fluid volume (AFV) increases from 30ml at 10 week and a peak of 1 litre at 34-36 wks and decreases in late 3rd trimester with a mean of 800ml at 40 wk of gestation. The rate of decline may be as high as 50ml per week at 38-43wks of gestation. The volume of amniotic fluid is ultimately decided by the volume of fluid flowing into and out of the amniotic sac. Amniotic fluid persistently circulates with an estimated exchange rate as high as 3600ml per hour. Fetal urination, lung and fetal swallowing all make an important contribution to the fluid movement in late gestational period. Fetal disorders affecting any of these processes will affect the AFV<sup>4</sup>.

Several studies addressed the association between maternal amniotic fluid volume (AFV) and intravascular volume.<sup>5</sup> Intravenous maternal hydration is relatively safe, easy and less invasive as compared to other invasive procedure with improved maternal compliance which can improve neonatal prognosis and decreased incidence of delivery complications.<sup>6</sup> Intravenous maternal hydration with hypotonic solutions causes osmotic changes that relates to parallel decrease in fetal osmolarity, increase in fetal urine flow and formation of amniotic fluid<sup>7</sup>.

One experimental study showed an increase of 58.6% in amniotic fluid volume after intravenous maternal hydration with hypotonic solution in 3<sup>rd</sup> trimester oligohydramnios<sup>6</sup>. Another international randomized clinical trial showed an increase of amniotic fluid index up to 95%.<sup>8</sup> Maternal osmotic

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Department of Obstetrics & Gynaecology, Jinnah Hospital, Lahore  
Correspondence: Dr. Nagina, Email: naginark@gmail.com,  
Cell: 03214597878

change rather than maternal volume expansion has more direct impact on increasing amniotic fluid volume with acute intravenous maternal hydration.

As there is no proper treatment for 3rd trimester oligohydramnios, the main purpose of conducting this study was to evaluate the effect of hydration in increasing amniotic fluid volume. By getting appropriate results of this study and reasonable increase in amniotic fluid index, intravenous maternal hydration may be beneficial in management of 3rd trimester Oligohydramnios and continuation of pregnancy up to term without complications.

## MATERIAL AND METHODS

A total of 156 females between 18 to 35 years, parity up to gravida 5, Singleton pregnant, gestational age from 28 wks to 40 wks, AFI less than 5cm were included in the study while women at risk of fluid overload such as those with cardiac, renal impairment (RFTs), to severe preeclampsia, diabetes, fetal congenital anomalies, rupture of membranes, significant hemorrhages, and acute febrile illness were excluded from the study.

The study population consisted of patients fulfilling the inclusion criteria presented in OPD & Emergency with history, clinical and USG evidence of Oligohydramnios. Determination of amniotic fluid volume with technique of phelan et al by dividing the uterus into four quadrants, measuring the deeper pool in each and calculating it as the sum of four measurements. In this study used equipment included Acuson model machine which was equipped with 3.5 and 5.0MHz curvilinear transducer. All measurements were made through medium transducer pressure to reduce intraobserver variability. Criteria oligohydramnios i.e an AFI <5cm, normal AFV being considered at AFI 8-24 cm, the informed consent was taken after explaining the benefits and risks associated with the management and used that data for my research work. They were assured regarding confidentiality and expertise. From each patient, detailed history was taken including demographic information (name, age, address and parity), present history (LMP, DOP) and obstetrical history. Patients were admitted in antenatal ward. Once baseline AFI was taking, woman were continuously infused 2 litres of dextrose water 5% over 2 hours. Throughout study these woman were supervised in the antenatal ward to ensure compliance and they had free access to toilet facilities. At the end of 2 hrs hydration period, AFI measurement was repeated. Maternal hydration was performed once and post hydration AFI was also performed once.

## RESULTS

The results of the study shows mean age in years  $27\pm 3.0$ , mean gestational age in weeks  $37\pm 2.4$ , mean weight in kg  $68.4\pm 2.7$ , mean AFI before and after hydration  $3.5\pm 0.6$  and  $6.3\pm 0.8$ , mean increase in AFI i.e.,  $2.9\pm 0.7$ . Maternal hydration increased amniotic fluid volume in patients with oligohydramnios. (Mean change in amniotic fluid index 2.9cm, 95% confidence interval; p-value <0.001). The mean percentage increase in AFI was  $87\%\pm 33.5$ .

## DISCUSSION

The results of this study showed that AFI was significantly increased with intravenous acute maternal hydration in 3<sup>rd</sup> trimester oligohydramnios. It indicates that increase in amniotic fluid volume results from either acute change in maternal fluid volume or maternal plasma osmolality or both.

By getting this significant increase in AFI after maternal hydration, a fetus can have more time for in utero growth and maturation and pregnancy can be continued up to the term without complications caused by reduced AFI or oligohydramnios.

This increase in AFI may be due to increase in fetal urine output.<sup>4</sup> or it may be due to reduced resorption of intramembranous amniotic fluid in response to fetal plasmaosmolality.<sup>6</sup> Our results agree with the established evidence for the role of maternal hydration in amniotic fluid dynamics<sup>5-9</sup>.

Although Single deepest technique is said to be the best method as it less likely lead to a false positive diagnosis of oligohydramnios but the most commonly used technique is amniotic fluid index.<sup>10</sup> For this reason we have taken amniotic fluid index as the method of detecting oligohydramnios. Normal amount of amniotic fluid volume during pregnancy is an issue to the practicing obstetrician. Important clinical decisions are made on the basis of the determination that whether the amniotic fluid volume is normal or not. Since oligohydramnios is associated with increase in perinatal morbidity and mortality diagnosed case of oligohydramnios should undergo appropriate workup. Proper antepartum surveillance is required.

Amniotic fluid index is the most commonly used quantitative indicator of amniotic fluid volume. In my study out of 156 women with oligohydramnios 47 showed about 100% increase in AFI, which is a significant increase to be considered. As in other study conducted by Ghafernejad<sup>11</sup> on pregnant women with oligohydramnios, before hydration AFI was 50.8 and after hydration became 67.2 showing a marked increase in AFI after acute hydration.

Hofmeyr<sup>8</sup> in 2009 concluded after a study that simple maternal hydration increases amniotic fluid volume and may be beneficial in management and prevention of oligohydramnios. But in that study compliance was a problem.

Age groups less than 30years and  $\geq 30$ years showed no significant difference in increase in AFI, where mean gestational age at presentation was 37 week of gestation.

Although maternal hydration increase the amniotic fluid index, neither the mechanism responsible for this change nor the length of time the increase would persist is definite till yet. It is also not known why amniotic fluid is decreased in some pregnancy states, it is acknowledged that fetal urine output is a major contributor to amniotic fluid volume after the 24<sup>th</sup> week of gestation. In adults diuresis is directly correlated with intravascular volume and osmolality. There are clinical data that fetus can respond to a maternal change in either intravascular volume and osmolality<sup>14,15</sup>.

Experimental data showed that fetal urine output changes with alteration in maternal osmolality, water deprivation and mannitol infusion resulting in a decrease in fetal urine flow in ewes, implicating maternal osmolality as an important variable<sup>13,12</sup>. However it is clarified that changes in fetal volume or osmolality may alter fetal urine output, amniotic fluid volume & fetal intravascular volume<sup>16</sup>.

Flack<sup>17</sup> conducted a study to determine whether acute maternal hydration in pregnancies with 3<sup>rd</sup> trimester oligohydramnios increases amniotic fluid index and hourly fetal urine production rate. Ten women with third trimester oligohydramnios and ten controls with AFI >7cm were prospectively recruited for this study. Once basal measurements were taken, women were advised to drink 250ml of water every 15minutes for a total of 2litres in 2hrs. In females with oligohydramnios, the mean amniotic fluid index increased from 4.3 to 7.5 cm after 2 hours of hydration. No change in AFI was observed in women with normal AFI, results of Flack are consistent with my study results as in our study women with oligohydramnios showed significant improvement in AFI after acute I/V maternal hydration.

Doi et al<sup>38</sup> showed that hydration of mothers modified their osmolality and thus improved amniotic fluid volume more than blood volume. On the other hand some studies indicated that improvement of uteroplacental perfusion as a result of increased plasma volume in mother would increase renal blood flow and improve fetal oxygenation.<sup>12</sup> However, there may be a possible confounding variable that should be discussed. It is not known for sure that the patient's hydration status before the intravenous hydration was good or not. As this study was not

designed to determine the mechanism by which maternal hydration increases amniotic fluid volume, so the implicated variables such as maternal osmolality, intravascular volume, fetal urine production rate, and Doppler study of fetomaternal circulation (umbilical artery, descending aorta, middle cerebral artery, renal artery and maternal uterine artery) were not measured. However, it seems more likely that infusion of 2litres hypotonic solution would decrease osmolality.

Dassari P<sup>21</sup> found cut off value for occurrence of fetal distress, prolonged pregnancies as AFI 8cm or less (odds ratio 7.50) & MVP of 2cm or less.

B.Bangal et al<sup>27</sup> found pregnancy induced hypertension (16%), post-dated pregnancy(16%), anhydramnios (10%) in women with oligohydramnios. Birth asphyxia ( apgar <7 at one and five minutes) was more common. Neonatal morbidity was primarily due to meconium aspiration and neonatal sepsis.<sup>27</sup>

About 69 out of 156 women had a change in AFI greater than mean change in AFI, and about 2.6% population showed major increase in AFI, that the AFI did increase very significantly in some women after maternal hydration raises several intriguing questions. Various confounding variables and methodological problems could account for this. In addition, perhaps relative maternal dehydration is an essential for maternal hydration to increase the AFI. This shows that low fluid intake is at least a partial result of maternal dehydration.<sup>28</sup> Sample size in our study is relatively smaller. A large scale study is required to predict the relationship between oligohydramnios and adverse fetal outcome. Definitely more accuracy could have been obtained if USG was done by the same sonologists.

## CONCLUSION

Under the condition of this study, maternal intravenous hydration significantly increased the AFV in women with third trimester oligohydramnios which may be beneficial in management of oligohydramnios and continuation of the pregnancy upto term without any complication.

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