Print ISSN: 2321-6379
Online ISSN: 2321-595X
DOI: 10.17354/ijss/2018/174

Original Article

# Amniotic Fluid Volume (q-AFV) Assessment for Intrauterine Growth Retardation in Hospital Settings

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## Abstract

**Background of the Study:** Low amniotic fluid volume (AFV) observed to be a commonly associated finding with intrauterine growth retardation (IUGR), so the present study was planned to study the association of low AFV (single deepest pocket [SDP] <2 cm) and IUGR.

**Materials and Methods:** The study was conducted in tertiary care hospital of Himachal Pradesh, India, among 100 mothers with clinically suspected IUGR in 75 and normal growth in 25, which were followed up from 28 weeks of pregnancy till delivery.

**Results:** There is an insignificant odds ratio (OR: 3.7; 95.0% CI: 0.5–30.4) for insufficient AFV (SDP <2 cm) and clinical IUGR. There were four perinatal deaths in IUGR and none in normal group. Mean birth weight of baby was significantly more in normal group (3.0 kg) as compared to IUGR group (2.2 kg) ($P$ = 0.001). Newborn was more active at the time of birth in normal group with average Apgar score of 7.2 in normal as compared to 5.9 in IUGR group ($P$ = 0.025). In IUGR group, the Apgar score increased significantly up to 8.8 once the assessment was made at 10 min ($P$ = 0.000).

**Conclusion:** AFV assessment will help as a facilitating tool for decision-making for the management of pregnancy rather substantiate itself as a sole tool with high predictive capacity.

**Key words:** Amniotic fluid volume, Intrauterine growth retardation, Pre-eclampsia

## INTRODUCTION

Intrauterine growth retardation (IUGR) is associated with high perinatal mortality due to congenital malformation, intrapartum asphyxia, meconium aspiration, hyperviscosity, hypothermia, and hypoglycemia.[1] Maternal health issues such as pregnancy-induced hypertension (PIH), diabetes mellitus, intrauterine infection, smoking, and poor nutrition are commonly observed to be associated with IUGR.[2,3] Better coverage of ultrasonographic method does ensure qualitative assessment amniotic fluid volume (AFV) which has described as a method to screen IUGR in a case of inadequate amniotic fluid. The presence of largest pocket of <1.0 cm perpendicular to uterine surface is considered as an indicative of insufficient AFV and of proxy to IUGR.[2,4]

Access this article online

www.ijss-sn.com

Month of Submission : 04-2018
Month of Peer Review : 05-2018
Month of Acceptance : 06-2018
Month of Publishing : 06-2018

Amniotic fluid is mainly of fetal origin with some maternal contribution through placental membranes. At term, fetal swallowing results in the removal of fluid of about 500 mL in a day, whereas urinary excretion is about 500 mL/day by child. The bulk of exchange in amniotic sac is very rapid with a turn over equivalent to total fluid volume in every 2–3 h. The volume of fluid reaches to 100–150 mL by 15 weeks, and thereafter, there is a steady increase of approximately 1000 mL at 36–38 weeks of gestation.[5,6] Clinical recognition of significant amniotic fluid changes is possible only in the second half of pregnancy and commonly occurs in last quarter of pregnancy. Oligohydramnios is a clinical hallmark of dysmature IUGR. It has been postulated that decreased production of fetal urine and insufficient breathing are associated with IUGR, so AFV assessment is determined

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by functional measure of IUGR. The present study was planned to study the presence of IUGR in accordance to AFV among mothers after 28 weeks' period of gestation (POG) till the time of delivery.

## MATERIALS AND METHODS

The present study was conducted in tertiary care setting among 75 clinically suspected IUGR and 25 normal newborns in the third trimester of pregnancy (28 weeks onward). Clinical criteria for including a case with IUGR were The inclusion criteria for a case with IUGR were height of uterus 4 weeks less than the POG, stationary or falling maternal weight, serial measurement of abdominal girth showing stationary or falling values, and diminished amount of liquor amnoi. Ultrasonographic examination was performed on RT 3000 (IGE India Ltd.) ultrasound using 3.5 mHz-phased array real-time transducer. Before examination, patient was asked to drink 24 ounces (720 mL) of fluid and refrain from voiding urine 3 h before the examination. The patient was examined in supine position with the application of non-greasy jelly, and examination was done with consistent serial sweeps in longitudinal and transverse planes. The largest amniotic fluid pocket was searched or measures in the vertical as well as transverse diameters. Classification of q-AFV was based on the smaller of the two diameters into the following three groups: Decreased (<1 cm), marginal (1–2 cm), and normal (2–8 cm). All mothers were followed up to 7 days of life for delivery with repeat q-AFV assessment, mode of delivery, birth weight of baby, Apgar score, and death.

## RESULTS

A total of 100 pregnant women were included at 28 weeks of POG, of which 75 were clinically suspected for IUGR and rest 25 were normal, and these two groups have a mean age of 24.3 and 23.8 years, respectively ($P = 0.561$). Primiparity was insignificantly different in both IUGR and normal cases ($P = 0.222$). In both the groups, majority of pregnancy completed up to 39 weeks of POG, and an extension of pregnancy for 41 weeks was found only in IUGR group (1.3%). Maternal complications such as PIH were observed among 12 cases in IUGR and in 3 normal cases, and 3 cases were observed with heart disease in IUGR group. Complications during pregnancy and labor were assessed, and majority (IUGR: 77.3% and normal: 88.0%) of mothers and newborns had no complications in both the groups [Table 1]. There is an insignificant odds ratio (OR: 3.7; 95.0% CI: 0.5–30.4) for insufficient AFV (single deepest pocket [SDP] <2 cm) and clinical IUGR.

**Table 1: Comparative assessment between clinically suspected pregnant mothers with IUGR and normal growth, Himachal Pradesh**

| Variable | IUGR (75) | Normal (25) | *P* value |
|---|---|---|---|
| Mean maternal age (+SD) | 24.3 (3.9) | 23.8 (3.1) | 0.561 |
| Primigravida (%) | 37.3 | 24.0 | 0.222 |
| Completed gestational age (%) | | | |
| 38 week | 53.8 | 44.0 | 0.418 |
| 39 week | 28.0 | 28.0 | 1.000 |
| 40 week | 17.3 | 28.0 | 0.248 |
| 41 week | 1.3 | 0.0 | NC |
| Mean birth weight in kg (+SD) | 2.2 (0.2) | 3.0 (0.3) | 0.001 |
| Mean APGAR score (+SD) | | | |
| 5 min | 5.9 (1.6) | 7.2 (0.8) | 0.025 |
| 10 min | 8.8 (2.0) | 9.7 (0.5) | 0.061 |
| Perinatal mortality/1000 LB | 53.3 | 0.0 | NC |
| AFV (%) | | | |
| Normal (2.0–8.0 cm) | 86.7 | 96.0 | 0.356* |
| Marginal (1.0–2.0 cm) | 10.7 | 4.0 | NC |
| Decreased (<1.0 cm) | 2.7 | 0.0 | NC |
| Mean birth weight in kg (+SD) in q-AFV category | | | |
| Normal (2.0–8.0 cm) | 2.2 (0.2) | 3.0 (0.3) | 0.001 |
| Marginal (1.0–2.0 cm) | 2.0 (0.5) | 2.9 (NC) | NC |
| Decreased (<1.0 cm) | 2.4 (NA) | - | NC |

*Yates corrected Chi-square, NC: Not computed, IUGR: Intrauterine growth retardation, AFV: Amniotic fluid volume

Pre-eclampsia was observed in 16.0% and 12.0% of mothers in IUGR and normal group, respectively. Complications such as premature rupture of membranes (2), active inversion of the uterus (1), congenital malformation (1), pathological jaundice (2) and intrauterine demise (2) were observed in IUGR group only. A total of 55 pregnancies in IUGR and 16 in normal group delivered babies normally through vaginal route, whereas cesarean section was done in 16 mothers of IUGR and 9 mothers in normal group to deliver baby.

Mean birth weight of baby was significantly more in normal group (3.0 kg) as compared to IUGR group (2.2 kg) ($P = 0.001$). Newborn was more active at the time of birth in normal group with average Apgar score of 7.2 in normal as compared to 5.9 in IUGR group ($P = 0.025$). In IUGR group, the Apgar score increased significantly up to 8.8 once the assessment was made at 10 min ($P = 0.000$). There was a significant improvement in Apgar score from 7.2 to 9.7 at 5 and 10 min respectively in newborn of normal group [Table 1]. The mortality up to 7 days of life was observed only in IUGR group where a total of 4 deaths were observed: Two died in intrauterine, one due to birth asphyxia, and one due to septicemia.

Criteria laid that AFV showed that majority (IUGR: 86.7, and normal: 96.0%) of cases in both the groups were having normal amniotic fluid, whereas decreased amniotic fluid was observed only in IUGR (2.7%) group. Mean birth weight was significantly more in normal (3.0 and 2.9 kg)

as compare to IUGR group (2.2 and 2.0 kg) in cases with normal and marginal AFV. No case was observed with decrease AFV in normal group, whereas it was observed in IUGR group with mean birth weight of 2.4 kg which is relatively more than the marginal AFV due to less number of cases (only 2) [Table 1].

Majority of mothers had normal AFV when assessed and the frequency distribution across POG from 28 to 40 weeks showed an increase for normal AFV in IUGR group after 35 weeks, whereas the fraction increased from 32 weeks of POG for normal AFV in normal group [Figure 1]. Prolonging labor in IUGR group, therefore, holds potential for an increase in AFV in the latter half of the pregnancy.

## DISCUSSION

AFV considered as a functional indicator for IUGR and its repeat assessment over a period of time gives an idea about intrauterine baby growth. The present study was planned to assess any association between insufficient AFVs with growth retardation. The present study observed 3 times odds (OR: 3.7; 95.0% CI: 0.5–30.4), but statistically insignificant, of insufficient AFV (SDP <2 cm) among clinically IUGR babies. In IUGR group, the present study showed a presence of suboptimal (<2 cm) AFV in 13.4%, whereas very low AFV (<1 cm) in 2.7% mothers. Birth weight as an outcome was assessed for less intrauterine growth and found that, in IUGR group, it was significantly (2.2 vs. 3.0 kg) lower than the normal group. All mothers delivered at tertiary care hospital and timely newborn care observed a significant improvement in Apgar from 5 to 10 min of life along with four deaths in perinatal period in IUGR group. Of these four, all 4 deaths were observed among women with normal and marginal AFV and none in women with decreased AFV (SDP <1 cm). Relatively low birth weight in women with normal AFV in IUGR group along with deaths did not support AFV as a functional indicator for screening growth retardation and perinatal death. Repeat assessment observed that, over a period of time (from 28 to 40 weeks) in both IUGR and normal groups, majority of mother become normal for AFV (2–8 cm) and only 2 mothers had very low AFV (<1 cm) and 8 has marginal (1–2 cm).

Evidence has demonstrated the predictive efficacy of AFV for IUGR as poor measure where amniotic fluid was measured by diazo-dye reaction.[7] In a study among 1038 women where amniotic fluid index (AFI) of more than 5.0 cm as quoted earlier, it turned out to be a poor screening test for small for gestational age fetus.[8] Effect of oligohydramnios in uncomplicated pregnancies was assessed and observed a significant association between AFI, 5 cm, and low birth weight (OR: 2.2, 95% CI: 1.5–3.2).[9] An assessment among 1393 pregnant women over 12 months' period observed no statistical significant association between AFI and estimated fetal weight with a conclusion that the fluid volume and index shows variations in the late half of the pregnancy which is non linear with the amniotic volume, index and fetal weight.[10]

Argument has placed that measuring amniotic fluid pockets is a reasonably reliable method to predict perinatal mortality with commonly used criteria of SDP <2 cm and AFI <5 cm, where before 34 weeks, AFI of <5 cm is a criteria for intensive fetal monitoring though it has greater sensitivity and precision but poor predictor of perinatal mortality. After 34 weeks, the use of either AFI or AFV assessment can expect to identify high-risk fetus reliably if repeat measurements are confirmatory.[11] Concordance to the present study evidence did observe AFV, specifically oligohydramnios as a poor predictor for perinatal mortality.[12] With a changing nutrition profile of

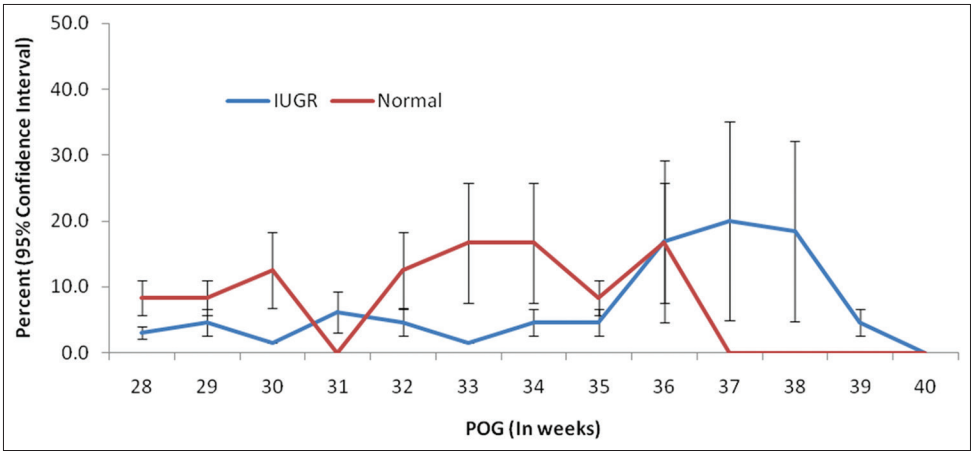


**Figure 1: Comparative trend for normal amniotic fluid volume over period of gestation between clinically suspected pregnant mothers with intrauterine growth retardation and normal growth, Himachal Pradesh**

and compliance, the bed rest recommended to mother over the period of pregnancy expects an improvement in AFV; therefore, follow-up assessment of AFV is recommended. Repeat assessment for AFV to decide the utility of volume as a prognostic indicator was also assessed in low-risk pregnancies, and finally, it was concluded that the repeat assessment has no prognostic significance.[13]

Method of assessment and subjective variations does influence the interpretation of findings and decision-making process. A study to assess the AFI and SDP as best technique was conducted where six publications compared the two and 21 had contained both techniques, it was found that AFI identified significantly greater number of women with oligohydramnios but without any difference with perinatal outcomes. AFI observed to over classify women with oligohydramnios with unwarranted interventions; therefore, AFI was recommended to be abandoned as a measure, rather preferred to use SDP to assess AFV.[14] Amniotic fluid may have a poor prediction due to changing volume over a pregnancy period which depends on fetus renal function and respiration along with mother nutritional status, but its implications in resource-poor settings warrant close monitoring as an adjunct for intrauterine growth monitoring of child and look for the presence of congenital anomalies.[15] AFV assessment will help as a facilitating tool for decision-making for the management of pregnancy rather substantiate itself as a sole tool with high predictive capacity. The current study has methodological limitations in a way where unequal distribution of pregnancies 75 and 25 in IUGR and normal group, respectively, without sample size estimation. The sample size distributed differentially and skewed which is evident form wide CI of odds ratio, a matched case–control study would have been better with 1:1 ratio. In addition, the present study had not considered AFI as an adjunct measure.

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**How to cite this article:** Chauhan A. Amniotic Fluid Volume (q-AFV) Assessment for Intrauterine Growth Retardation in Hospital Settings. Int J Sci Stud 2018;6(3):44-47.

**Source of Support:** Nil, **Conflict of Interest:** None declared.