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Comparison of single deepest vertical pocket measurement with amniotic fluid index in assessing pregnancy outcome

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Abstract
Background: Amniotic fluid estimation by ultrasound is an essential component of fetal assessment in utero. The present study aimed to measure and compare two semiquantitative methods of estimation of amniotic fluid i.e. single deepest vertical pocket with amniotic fluid index in prediction of adverse pregnancy outcomes.
Methods: Study included 120 booked pregnant women of 34 to 41weeks POG who were followed till minimum 48hours after delivery. They were divided in to two groups of 60 each, in Group-I, amniotic fluid volume estimation was done by Amniotic Fluid Index (AFI) and in Group-II by Single Deepest Vertical Pocket (SDVP) technique. AFI ≤5cm in group-I and SDVP<2cm in group-II were identified as Oligohydramnios and feto-maternal outcomes were compared.
Results: Oligohydramnios was diagnosed in 4 (7%) in group-I and 5 (8%) patients in group-II which was statistically not significant. Biophysical scoring, doppler parameters, induction of labour, intrapartum CTG, rate of cesarean section and admission to NICU were not statistically different in both the groups.
Conclusion: Both AFI and SDVP techniques for amniotic fluid volume (AFV) estimation were similarly effective in diagnosing oligohydramnios and predicting adverse pregnancy outcome.

Keywords: Amniotic fluid index, single deepest vertical pocket, oligohydramnios, feto-maternal outcome, biophysical scoring

1. Introduction
Amniotic fluid is essential for normal fetal growth and development [1]. It provides a protective milieu for the growing fetus, cushioning it against mechanical and biological injury. It provides physical space for fetal movement that is required for normal musculoskeletal development. It also facilitates normal gastrointestinal tract and lung development by allowing fetal swallowing and breathing respectively [1, 2]. Abnormally decreased amount of amniotic fluid volume, known as Oligohydramnios complicates about 1-2% of pregnancies[3]. Decreased amniotic fluid can be due to various causes such as major anomaly in fetus specifically involving genitourinary tract, pulmonary hypoplasia, early rupture of fetal membranes, fetal growth restriction, placental abnormality, preeclampsia and post maturity [1]. Decreased amniotic fluid volume (AFV) in a pregnancy without fetal renal agenesis or obstructive uropathy is believed to indicate a fetal response to chronic stress and is associated with increased fetal and neonatal morbidity and mortality [4].
Several methods are used to evaluate amniotic fluid volume. Ultrasound test is ideal as it is non-invasive and can be applied on large scale and be used frequently for repeat AFV estimation in cases of suspected abnormalities [5].
The semiquantitative criteria -Amniotic Fluid Index (AFI) originally proposed by Phelan *et al.* in 1987, is based on sum total of the deepest vertical pockets in each of the four quadrants of gravid uterus [6]. AFI ≤5 cm is defined as oligohydramnios. Single Deepest Vertical Pocket (SDVP) was introduced by Manning *et al.* in 1984, in which AFV is determined by measuring depth of maximum vertical pocket [7]. According to this absence of a pocket measuring 2×1 cm is indicative of decreased amniotic fluid volume.
Often, delivery by Induction of labor or cesarean section is planned after diagnosing decreased amniotic fluid volume at term by many caregivers. However, there is no clear consensus on the best method to assess amniotic fluid adequacy [4].

In other words, there is lack of a gold standard test to diagnose decreased amniotic fluid volume.
These measurements of amniotic fluid volume are used in biophysical profile which is a method of fetal surveillance. Biophysical profile consisting of single deepest pocket, fetal movement, fetal tone, fetal breathing and non-stress test and in Modified biophysical profile consisting of non-stress test and amniotic fluid index only.

2. Material and Methods

The Prospective Observational study was undertaken in the Department of obstetrics and gynaecology, PGIMER and Dr. Ram Manohar Lohia Hospital, New Delhi from November 2017 - March 2019. The study was approved by the institutional ethics and review board.
A total 120 consenting pregnant women fulfilling the inclusion and exclusion criteria were enrolled from antenatal clinic and maternity word for the study.

2.1 Inclusion criteria: Women fulfilling all three criteria were included

2.1.1 Gestational age 34-41weeks, who needed test for assessment of fetal wellbeing
2.1.2 Singleton live pregnancy and cephalic presentation
2.1.3 Confirmed dates by first trimester scan

2.2 Exclusion criteria

2.1.4 Premature rupture of membranes
2.1.5 Fetal structural and chromosomal malformation
2.1.6 Uncontrolled gestational diabetes
2.1.7 Women with diagnosed placental anomalies

A detailed history, thorough clinical examination and relevant investigations were done for all the study subjects. All ultrasound examinations were done in confirmation to the PCPNDT act.
The following information was collected from all the participants under the study:

1. Complete history
2. Thorough general physical and systemic examination
3. Antenatal investigations including-
   a. Blood sugar: Fasting, post-prandial, Glucose challenge test
   b. Dating scan and Level-II anomaly scan

4. Ultrasonography for amniotic fluid volume estimation

These women were divided into two equal groups of 60 each (group-I and group-II), by random allocation.
Group-I -AFV estimation done using AFI technique
Group-II-AFV estimation done using SDVP technique

2.2 Method of Amniotic fluid estimation

The machine used for measurement of amniotic fluid was SEIMENS USG machine fitted with a 3.5 MHZ curvilinear transabdominal and 6.5 MHZ transvaginal probe. The probe was 3.5 MHZ curvilinear transabdominal probe.

2.3 AFI and SDVP measurement technique

Phelan's technique was used for AFI measurement[6]. In this technique patient is placed in supine position. Gravid uterus is divided into four quadrants using the maternal sagittal midline vertically passing through linea nigra and an arbitrary transverse line approximately halfway between the symphysis pubis and the upper edge of the uterine fundus passing through umbilicus. The transducer was kept parallel to the maternal sagittal plane and perpendicular to the maternal coronal plane throughout. The deepest unobstructed and clear pocket of amniotic fluid free of umbilical cord and fetal extremities was taken. The ultrasound calipers were manipulated to measure the pocket in a strictly vertical direction. The process was repeated in each of four quadrants and the pocket measurements summed up to calculate the AFI. If the AFI is <8 cm, the four-quadrant evaluation is done three times and average was taken to obtain the AFI.

2.4 For calculating the SDVP, the vertical (right angle to the uterine contour) and transverse diameters of the largest pocket of amniotic fluid was measured. The SDVP is simply the largest vertical pocket of fluid that is at least 1cm in width [5].

Patients enrolled were subjected to amniotic fluid estimation by one of the techniques and the technique was decided by random allocation. Ultrasonography was repeated in patients with normal AFI at 2weekly /weekly interval as required. Patients with AFI≤5cm or absence of a pocket measuring 2×1cm were diagnosed as oligohydramnios. In patients with oligohydramnios, colour doppler and biophysical profile was done.

5. Non-Stress Test
6. Intrapartum Cardiotocography

All the study subjects were followed up throughout pregnancy, during labour and for at least 48hours post-partum.
Feto-maternal outcomes were studied in terms of:

2.5 Primary outcome: Non-reassuring fetal heart rate tracing in Labor

2.6 Secondary Outcome

2.6.2 Neonatal outcomes: admission to neonatal intensive care unit, presence of meconium, Apgar score less than 7 at five minutes, umbilical artery pH less than 7.1.
2.6.3 Abnormal doppler changes
2.6.4 Maternal outcome (Normal vaginal delivery, operative delivery, cesarean section)

2.7 Statistical Analysis

Categorical variables were presented in number and percentage (%) and continuous variables were presented as mean ± SD and median. Normality of data was tested by Kolmogorov-Smirnov test. If the normality was rejected then non parametric test was used.

2.8 Statistical tests were applied as follows

2.7.2 Quantitative variables were compared using Independent t test/Mann-Whitney Test (when the data sets were not normally distributed) between the two groups.
2.7.3 Qualitative variables were correlated using Chi-Square test/Fisher's Exact test.

- A p value of <0.05 was considered statistically significant.
- The data was entered in MS EXCEL spreadsheet and analysis was done using Statistical Package for Social Sciences (SPSS) version 21.0.

3. Results

In the study amniotic fluid volume measured was correlated with various feto-maternal outcomes. Out of 60, 4(7%) had

oligohydramnios i.e.; AFI≤5cms and 56 (93%) had AFI>5cm (Table-1). Out of 60, 5(8%) had oligohydramnios i.e.; SDVP<2cm and 55 (92%) had SDVP ≥2cms (Table-2).

Table 1: AFI≤5cms and 56 (93%) had AFI>5cm Out of 60

AFI (Group-I)	No. of patients	Percentage
≤5	4	7%
>5	56	93%
Total	60	100%

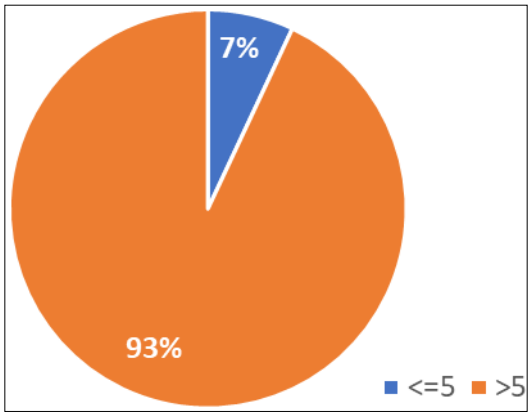

Fig 1: Afi Distribution

Table 2: SDVP<2cm and 55 (92%) had SDVP ≥2cms

SDVP (Group-II)	No. of patients	Percentage
< 2	5	8%
≥2	55	92%
TOTAL	60	100%

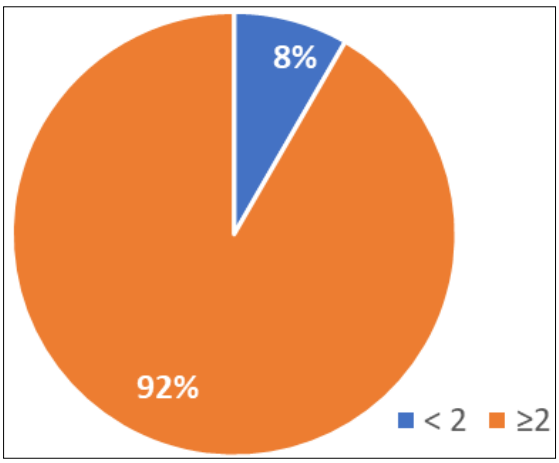

Fig 2: SDVP distribution

Mean age of patients in group-I was 27.85 years (SD-3.66) and in group-II was 27.82years (SD-3.82) which were comparable. Whereas the mean age of patients with oligohydramnios by AFI technique was 28.25years and 27.4years by SDVP technique and the difference was not statistically significant.

In the present study out of 60 patients 35(58.33%) were primigravida and 25(41.67%) were multigravida in group-I and 30(50.00%) were primigravida and 30(50.00%) were multigravida in group-II. The two groups were statistically not significant with regard to parity(p=0.360).

In present study mean gestational age at delivery was 38.49 in both group-I and group-II with standard deviation of 0.98 in Group-I and 1.24 in group-II and was comparable in both the groups.

Table 3: Fetomaternal outcomes in women with oligohydramnios by AFI and SDVP technique

	AFI(GROUP-I)	SDVP(GROUP-II)	P-Value
Incidence of Oligohydramnious	4 (6.67%)	5 (8.33%)	0.731
Abnormal BPS	0(0.00%)	1(20%)	0.371
Doppler Changes	1(25%)	0(0.00%)	0.26
ABN. Intrapartum CTG	0(0.00%)	1(20%)	0.371
Rate of Cesarean	2(50%)	2(40%)	0.77
MSL	1(25%)	1(20%)	0.865
Apgar<7 at 5min.	0(0.00%)	0(0.00%)	-
Cord Ph (<7.1)	0(0.00%)	1(20%)	0.731
Nicu admission	3(75%)	3(60%)	0.654

4. Discussion

Women with oligohydramnios have been considered at increased risk of perinatal morbidity, and it is often used as an indication for delivery. Decreased amniotic fluid volume is believed to indicate a fetal response to chronic stress, so the evaluation of the amniotic fluid volume is an integral component of the fetoplacental assessment [8].

In present study, 120 booked antenatal patients were taken and divided into Group-I and Group-II, 60 in each group. In group-I, Amniotic fluid index (AFI) was measured by Phelan's technique and in group-II, Single deepest vertical pocket (SDVP) was measured. These were further subdivided into group-IA (AFI≤5cm), group-IB (AFI>5cm) and group-IIA (SDVP<2cm), group-IIB(SDVP≥2cm). Amniotic fluid estimation done within one week of delivery was taken into consideration for correlation with perinatal outcome in both the groups.

In present study number of patients diagnosed with oligohydramnios was 4 (7%) in group-I (AFI ≤5cm) and 5 (8%) in group-II (SDVP<2cm) which was statistically not significant. A study by Chauhan *et al*. in 2004 found significantly more patients were identified as having oligohydramnios using AFI (17%) compared with using 2×1 pocket (10%) (P = .002) [9]. Nabhan *et al.* in 2010 observed when AFI was used, significantly more cases were diagnosed as oligohydramnios (RR 2.39, 95% CI 1.73 to 3.28) [10]. However, a study by Dasari *et al.* in 2006 observed incidence of oligohydramnios was 34% by AFI method and 59% by SDVP and in this AFV was measured only in post-dated pregnancies [11]. Rosati *et al.* in 2015 found oligohydramnios in 68.1% in both AFI and SDVP measurements [12].

No patients with oligohydramnios by AFI and SDVP techniques had abnormal BPS i.e.; BPS<8. So, no correlation had been found between oligohydramnios and abnormal BPS. Abnormal doppler was seen in 1(25%) patient in AFI<5cm group and no patients had abnormal doppler changes in patients with SDVP≤2cm and were statistically insignificant. Patel *et al.* in 2015 found abnormal doppler changes in 38 (47.50%) patients with oligohydramnios (AFI<5) group compared to 24 (7.50%) in AFI>5cm group with a P value of < 0.0001 [13]. Jagatia *et al.* in 2013 observed 7% patients with oligohydramnios (<5cm) had

fetoplacental insufficiency on doppler study [14].

In our study in group-I no patients with AFI≤5cm (group-IA) had abnormal CTG and in group-II 1 (20%) patient with SDVP<2cm (group-IIA) had abnormal CTG i.e.; late deceleration, which was statistically not significant. Dasari *et al*. found most common FHR pattern was variable deceleration (>60%) in pregnancies with oligohydramnios, irrespective of the technique used to determine AFV and the study was undertaken in post term pregnancies [11]. No evidence of a difference between two groups in detecting abnormal CTG was found by Nabhan *et al*. [10]. A study by Mukhopadhyay *et al*. found abnormal CTG pattern was significantly higher in AFI group as compared to SDVP group [15].

In group-I, 49 (81.67%) and in group-II, 47 (78.33%) had vaginal delivery. Eleven (18.33%) in group-I and 13 (21.67%) in group-II underwent cesarean section which were statistically not significant (p value 0.77). Labor was induced in 36 and 28 patients in group-I and group-II respectively which were comparable in both the groups (0.526). In group-IA (AFI≤5), 2 (50%) patients were induced for oligohydramnios and in group-IIA, 1 (20%) patient was induced for oligohydramnios. Study by mukhopadhyay *et al*. found increased rate of induction of labour in AFI groups [15]. A study by Nabhan *et al*. observed higher rate of induction of labor when AFI was used for fetal surveillance[10]. However, study by Shah *et al*. found no statistical significant difference between the two groups in terms of rate of induction and mode of delivery [8].

In AFI≤5 cm (group-IA), 2 (50.00%) and in SDVP<2 cm (group-IIA), 2 (40.00%) patients had cesarean section. Mukhopadhyay *et al*. found increased rate of cesarean section in AFI groups [11]. Nabhan *et al*. observed no evidence of difference of cesarean section between the two groups [10]. Chen *et al*. found rate of cesarean section was very high in both the groups and no method was superior in predicting need for cesarean section (AFI≤5 cm vs SDVP<2cm:97.5% vs 95.2%) [16].

Mean Apgar score was 8.75 ± 0.5 in AFI≤5cms and 8.8 ± 0.45 in SDVP<2cms groups and no correlation had been found in both groups with low Apgar score at 5minutes in our study. A study by Shah *et al*. found there was no significant difference between the two groups in terms of Apgar at 5minutes [8].

No patient in AFI≤5 group and 1(20%) in SDVP<2cm group had cord pH<7.1 in our study. A study by Kehl *et al*. found umbilical arterial pH <7.10 more often when SDVP technique was used [17]. Ajayi *et al*. found umbilical venous pH <7.15 more in AFI≤5 groups[18]. While Nabhan *et al*. observed no evidence of a difference between the two groups [10].

In AFI≤5 group, 1 (25.00%) and 2 (40.00%) in SDVP< 2 cm group required NICU admission and was statistically not significant (p=0.654). A study by Kehl *et al*. found no difference between the two groups for the rate of admission to NICU [17]. In another study by Shah *et al*. found no statistical significance in rate of admission to NICU in both the groups [8].

5. Conclusion

Both AFI and SDVP techniques for amniotic fluid volume (AFV) estimation were similarly effective in diagnosing oligohydramnios and assessing pregnancy outcome. However more studies with large sample size is needed to conform the correlation between oligohydramnios by AFI and SDVP techniques and various feto-maternal outcomes.

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