

EVALUATION OF FETOMATERNAL OUTCOMES USING AMNIOTIC FLUID INDEX AND SINGLE DEEPEST VERTICAL POCKET FOR AMNIOTIC FLUID VOLUME ASSESSMENT

Mariyam Haroon, Abeera Choudry, Madiha Ahmed, Mahwish Gul*, Anam Altaf**

Pak Emirates Military Hospital/National University of Medical Sciences (NUMS) Rawalpindi Pakistan, *Ayub Medical College, Abbottabad Pakistan, **Al-Shifa School of Public Health, Rawalpindi, Rawalpindi

ABSTRACT

Objective: To compare fetomaternal outcomes using amniotic fluid index and single deep vertical pocket for estimating amniotic fluid volume among pregnant women.

Study Design: Comparative prospective study.

Place and Duration of Study: Department of Obstetrics and Gynaecology, Pak Emirates Military Hospital, Rawalpindi, from Aug 2019 to Feb 2020.

Methodology: Sample of 110 pregnant women was calculated with WHO calculator. We used non probability consecutive sampling as effective sampling technique. Research approval and patient consent were taken before initiation of study. Patients were randomly divided into two groups; group A underwent amniotic fluid index measurement while group B underwent single deep vertical pocket measurement. Feto maternal outcomes were measured in both groups.

Results: Total 110 pregnant women were included in our study (55 women in each group). Mean age of women was 26.9 ± 4.6 SD. In Amniotic fluid index group, preeclampsia 14 (12.7%) vs 5 (4.5%) respectively, $p=0.04$, rupture of membrane 12 (10.9%) vs 4 (3.6%) respectively, $p=0.05$ was significantly higher as compared to single deep vertical pocket group. Patients with oligohydroamnios were significantly higher in amniotic fluid index group as compared to single deep vertical pocket 15 (13.6%) vs 3 (2.7%), respectively, $p=0.04$.

Conclusion: Amniotic fluid volume assessment could be done with both amniotic fluid index and single deep vertical pocket method. Single deep vertical pocket is safe, effective and better diagnostic choice for amniotic fluid assessment as it is associated with avoidance of unnecessary interventions without affecting peripartum outcomes.

Keywords: Amniotic fluid volume, Amniotic fluid index, Single deep vertical pocket.

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INTRODUCTION

Amniotic fluid is an essential fluid that surrounds foetus throughout pregnancy. It is a clear and yellowish liquid within amniotic sac that is associated with normal growth and development of foetus¹. Amniotic fluid is required for normal development of gastrointestinal tract, respiratory system, urinary tract and musculoskeletal system of foetus during gestation. Amniotic fluid helps foetus in prevention of infection, protection from trauma and provide bacteriostatic properties². Amniotic fluid is also associated with prevention of placenta and umbilical cord compression. It

protects fetal nutritional and vascular compromises³.

Amniotic fluid normal level is an important indicator of proper foetal development and functioning, however, low level of this liquid leads to incomplete lung development and poor growth of foetus⁴. Amniotic fluid measurement is usually done with amniotic fluid volume (AFV) assessment. AFV measurement is done directly (at the time of cesarean or uterine hysterotomy), indirectly (amniocentesis by dye dilution technique) and through estimated sonographically⁵.

Amniotic fluid index (AFI) is summation of largest pocket vertical diameter (in each of 4 quadrants) with maternal umbilicus (as central reference). The index requires longitudinal plane

Correspondence: Dr Anam Altaf, House No 254, MR-6, B Block, B-17 Islamabad Pakistan

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orientation for transducer and each pocket with minimum horizontal measurement (1cm)⁶. Chamberlain proposed single deepest vertical pocket as identification of largest pocket of amniotic fluid (after global assessment) and largest vertical measurement selection (with minimum horizontal measurement of 1 cm). Amniotic fluid index is an important indicator for obstetric management. Reduction in AFV relative to gestational age is termed as oligohydramnios. In oligohydramnios, AFI is usually ≤ 5.1 cm⁷. Several studies reported a borderline AFI of 5.1 cm to 8 cm. Incidence of AFI 5.1 to 8 cm varies from 6 to 44% with overall rate 12%⁸.

Kehlt *et al*, reported that patients in AFI group had more cases of oligohydramnios as compared to single deep vertical pocket (9.8% versus 2.2%, $p < 0.01$)⁹. Mukhopadhyay *et al*, reported that majority of AFI group patients showed non reassuring foetal heart rate as compared to SDVP (36% vs 14%, $p = 0.01$)¹⁰. Amniotic fluid had greater impact on pregnancy outcome, however, there is no evidence of its assessment method superiority. Present study results will help to understand and efficacy of AFI and SDVP in terms of fetal and maternal outcomes. Limited data is available on amniotic fluid index and single deep vertical fluid assessment in terms of fetomaternal outcomes in Pakistan. Present study aims to compare fetomaternal outcomes using amniotic fluid index and single deep vertical pocket for estimating amniotic fluid volume among pregnant women.

METHODOLOGY

A comparative prospective study was conducted at Department of Gynecology and Obstetrics, Pak Emirates Military Hospital, Rawalpindi, from August 2019 to February 2020. A sample size of 110 women was calculated with P1=36%, P2 14%, 80% power of study, 95% confidence interval using WHO calculator (55 patients in each group)¹⁰. Pregnant women were selected with non probability sampling (consecutive technique). Research approval was taken from ethics committee of corresponding hospital (IRB-4840).

Consent forms were taken from all participating women. Women with age > 20 years, single ton pregnancy (> 28 weeks of gestation with live fetus) with fetus in cephalic position coming to OPD were included in study. Exclusion criteria was based upon women who had primary cesarean section, premature rupture of membrane, fetal malformations, both structural or chromosomal, placenta previa, no ultrasound in last 7 days, intrauterine fetal death, presence of gestational diabetes or hypertension, fetal growth restriction, intrahepatic cholestasis, suspected placental insufficiency and any other vaginal delivery contraindication. Women in labor ward were randomly (computer generated random number table) divided into two groups; Group A assigned AFI measurements (by dividing uterine cavity into 4 quadrants, largest vertical diameter of fluid pocket was assessed in each quadrant and summed up to provide single value for AFI. Group B assigned single vertical diameter pocket measurement (by calculating largest vertical diameter of fluid pocket). Absence of pocket (measuring at least 2x1 cm) and AFI ≤ 5 cm was termed as oligohydramnios. Fetomaternal outcomes were measured in both groups. SPSS version 24 was used for data analysis. Mean and standard deviation was calculated for nominal data, however, frequencies and percentages were calculated for qualitative variables. Effect modifiers such as maternal age and gestational age were controlled through stratification technique. Post stratification chi-square test was applied in our study. In our study, p -value ≤ 0.05 was considered statistically significant result.

RESULTS

Total 110 pregnant women were included in our study (55 women in each group). Mean age of women was 26.9 years \pm 4.6 SD. There were 80 (72.7%) women in 20-30 years age group and 30 (27.3%) women in 31-40 years age group. Mean gestational age was 38 weeks \pm 1.2 SD. Mode of delivery was vaginal in 76 (69.1%), assisted vaginal in 15 (13.4%) and cesarean in 19 (17.3%) women. Overall primigravida was found in 50 (44.6%) and multigravida in 60 (53.6%) women.

Overall, preeclampsia was reported in 19 (17.3%) women and preterm labor was found in 16 (14.5%) women. Placental abruption was reported in 6 (5.5%), rupture of membrane in 16 (14.5%) and cervical ripening in 9 (8.2%). Overall, mean amniotic fluid volume was $6.5 \text{ cm} \pm 2.6 \text{ SD}$.

In AFI group, majority of women had normal delivery 37 (33.6%) following assisted vaginal delivery 9 (8.2%) and C section 9 (8.2%). In SDVP group, majority of women had normal

Table-I: Comparison of maternal outcomes in Amniotic fluid index and Single deep vertical pocket group.

Maternal outcomes	Interventional Groups		p-value
	Amniotic fluid index group	Single deep vertical pocket group	
Mode of Delivery			
Normal	37 (33.6%)	39 (35.5%)	0.703
Assisted	9 (8.2%)	6 (5.5%)	
C section	9 (8.2%)	10 (9.1%)	
Primigravida			
No	25 (22.7%)	35 (31.8%)	0.08
Yes	30 (27.3%)	20 (18.2%)	
Multigravida			
No	25 (22.7%)	25 (22.7%)	1.00
Yes	30 (27.3%)	30 (27.3%)	
Preeclampsia			
No	41 (37.3%)	50 (45.5%)	0.04
Yes	14 (12.7%)	5 (4.5%)	
Pre Term Labor			
No	41 (37.3%)	48 (43.6%)	0.144
Yes	14 (12.7%)	7 (6.4%)	
Rupture of Membrane			
No	43 (39.1%)	51 (46.4%)	0.05
Yes	12 (10.9%)	4 (3.6%)	

vaginal delivery 39 (35.5%) following C section 10 (9.1%) and assisted vaginal delivery 6 (5.5%) ($p=0.703$). AFI group had high number of patients with primigravida as compared to SDVP group (27.3% vs 18.2%, $p=0.08$). In our study, multigravida did not show any statistical significance between both groups ($p=1.00$). Preeclampsia was significantly lower in SDVP group as compared to AFI group (4.5% vs 12.7%, $p=0.04$). Pre term labor was found to be lower in SDVP as compared to AFI (6.4% vs 12.7%, $p=0.144$). Rupture of membrane was significantly higher in AFI group

as compared to SDVP (10.9% vs 3.6%, $p=0.05$) as shown in table-I.

Majority of women in AFI group were diagnosed with oligohydroamnios 15 (13.6%) while in SDVP group 3 (2.7%) women were diagnosed with oligohydroamnios ($p=0.04$). In AFI group 6 (5.5%) had abnormal CTG while in SDVP group 3 (2.7%) had abnormal CTG ($p=0.489$). In AFI group 16 (14.5%) had ≤ 7.10 arterial pH while 39 (35.5%) had arterial pH > 7.10 . In SDVP group 13 (11.8%) had arterial pH ≤ 7.10 while 42 (38.2%)

Table-II: Comparison of fetal outcomes in Amniotic fluid index and single deep vertical pocket group.

Fetal outcomes	Interventional Groups		p-value
	Amniotic fluid index group	Single deep vertical pocket group	
Oligohydroamnios			
No	40 (36.4%)	52 (47.3%)	0.04
Yes	15 (13.6%)	3 (2.7%)	
Abnormal Cardiotocography			
No	49 (44.5%)	52 (47.3%)	0.489
Yes	6 (5.5%)	3 (2.7%)	
Arterial PH			
≤ 7.10	16 (14.5%)	13 (11.8%)	0.66
> 7.10	39 (35.5%)	42 (38.2%)	
Arterial Base Excess			
≤ -12	18 (16.4%)	17 (15.5%)	1.00
> -12	37 (33.6%)	38 (34.5%)	
5 Min Appearance, Pulse, Grimace, Activity, and Respiration Score			
≤ 7	17 (15.5%)	10 (9.1%)	0.183
> 7	38 (34.5%)	45 (40.9%)	
Fetal Distress			
No	51 (46.4%)	53 (48.2%)	0.679
Yes	4 (3.6%)	2 (1.8%)	

had arterial pH > 7.10 ($p=0.66$). Arterial base excess was ≤ -12 in 18 (16.4%) in AFI group while in SDVP group 17 (15.5%) had ≤ -12 base excess ($p=1.00$). 5 min apgar scores were ≤ 7 in 15.5% women of AFI group and 9.1% women of SDVP group ($p=0.183$). Fetal distress was low in SDVP group as compared to AFI group (3.6% vs 1.8%, $p=0.67$) as shown in table-II.

DISCUSSION

Assessment of amniotic fluid volume is an important part of fetal well being, integral

component of fetal assessment in low and high risk pregnancies. Amniotic fluid index and single deep vertical pocket technique choice is very essential for understanding clinical efficacy because ultrasound test might lead to morbidity¹¹. Amniotic fluid assessment accuracy is related to diagnostic criteria, fetal position, adequate measurement, operator experience and presence of abdominal mass or scar¹².

In our study, AFI was effective in diagnosing women with oligohydramnios more frequently as compared to SDVP (13.6% vs 2.7% respectively, $p=0.04$). Several studies have been conducted on comparison of AFI and SDVP as screening method for adverse pregnancy outcomes prevention. Magnan and colleagues reported that women with AFI higher than 5.0 cm had SDVP $>2.0\text{cm}$ ¹³. Chauhan and colleagues reported that AFI diagnosed 17% women with oligohydramnios as compared to SDVP (2x1) 10% ($p=0.002$). They found that single deepest pocket is associated with low suspicion rate of oligohydramnios as compared to AFI¹⁴. Similar findings were reported by Magnan *et al*. That AFI is more effective in labeling twice women at risk of having oligohydramnios as compared to SDVP¹⁵.

In our study, mode of delivery did not show any impact on amniotic fluid assessment with AFI or SDVP. However, Alfirevic *et al*, reported that despite of no statistical significance between amniotic fluid indices and mode of delivery, we found a positive trend towards c section¹⁶. Moses *et al*, reported that both techniques are unable to identify c-section delivery for fetal distress and late deceleration associated with delivery influence¹⁷.

In our study, no significant difference in arterial pH ($p=0.66$) and 5 min APGAR scores ($p=0.183$) was found in both groups. Rosati *et al*, reported that there is no significance difference in perinatal outcomes like umbilical artery pH <7.1 and APGAR scores at 5 minutes <7 . They also reported that in prolonged induced pregnancies, perinatal outcomes are not affected by oligohydramnios¹⁸. Nibhan *et al*, also did not find any

evidence of superiority of AFI or SDVP in terms of Apgar scores less than 7 and at 5 minutes and umbilical artery pH <7.1 ¹⁹. Sarno and colleagues reported high rate of C-section for low APGAR scores and fetal heart rate in association with AFI (below 5 cm cut off point). The findings led to excessive adoption of AFI for amniotic fluid assessment during fetal surveillance (Antepartum)²⁰.

LIMITATION OF STUDY

Conduction of study at single center and choice of pregnant women at low risk limits generalisability of study.

CONCLUSION

Amniotic fluid volume assessment could be done with both amniotic fluid index and single deep vertical pocket method. Single deep vertical pocket is safe, effective and better diagnostic choice for amniotic fluid assessment as it is associated with avoidance of unnecessary interventions without affecting peripartum outcomes.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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