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Original Research Article

Sonographic Correlation between Maximum Vertical Pocket and Amniotic Fluid Index in Second and Third Trimester

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Abstract: ***Background:*** Amniotic fluid (AF) is a fluid that encompasses the fetus as it is growing in uterus and provides nutrients. The amniotic fluid index and maximum vertical pocket technique are two frequently used ultrasound tests to estimate amniotic fluid volume. ***Objective:*** The goal of study is to access AFV and to correlate AFI and MVP in second and third trimester. ***Method:*** In this study, 100 pregnant females of various ages in their second and third trimester were taken. Xario and Z-5 ultrasound Doppler devices with trans-abdominal (3.5-5MHz) probes were used. The FOUR QUARDRANT METHOD and SINGLE POCKET METHOD were used to determine the amount of amniotic fluid. The patient's data were used with permission of ultrasound department at study site. ***Results:*** Out of 100 women, 40 were in their second trimester and 60 were in their third trimester. The AFI technique was used to evaluate the majority of the female patients (60%) and the maximum vertical pocket technique was used to assess 40 (40%) of the female patients. 12 (12%) of 100 patients had oligohydramnios, 18 (18%) had polyhydramnios, 4 females had hazy amniotic fluid, 13 (13%) had hypotension, 2 (2%) had hypertension, and only 1 (1%) had diabetes. ***Conclusion:*** Both AFI and SDP were used to determine fluid adequacy. These techniques are helpful in assessing oligohydramnios and polyhydramnios. The typical AFI range is among 5-22.

Keywords: Amniotic fluid volume, Amniotic fluid index, Maximum vertical pocket technique, Oligohydramnios, Polyhydramnios.

INTRODUCTION

Amniotic fluid (AF) is an unpredictable material which encompasses the fetus as it is growing in the womb. Amniotic fluid (AF), which is an ultimate vigorous environment, shifts as pregnancy continues plus provides a source of water for embryo while still shielding from injury. Several fundamental nutrients and development features found in amniotic fluid aid in fetal growth, provide Cushioning and serves as antimicrobial effectors, protecting the fetus while also allowing for assessment of fetal maturity and disease [1]. Amniotic sac that's otherwise called amnion begins to form on 12th day after conception. Amnion is made up of two layers that encompass the fetus and the amniotic cavity [2]. Amniotic fluid volume (AFV) is a fundamental part for the assessment of fetal well-being. The non-invasive technique that is often used to monitor the progress of pregnancy is ultrasonography. The compartments of amniotic fluid is viewed as an anechoic zone pretty much encompassing the fetus. Punctiform or spicular echoes might be seen moving about in compartment [3]. Occasionally it may include echogenic particles, giving it a hazy appearance. The vernix, inflammation and intraamniotic hemorrhage in third trimester is responsible for these echogenic particles. It is due to shedding of fetal skin [4]. Initially, fetal urine and fetal lungs aid in the production of amniotic fluid. The network of blood vessels on the fetal surface of the placenta transports amniotic fluid and solutes from the amniotic cavity to the fetus. The amount of amniotic fluid varies with age and get to its peak between 36-38 weeks of pregnancy [5]. The Dye dilution technique for assessing amniotic fluid volume showed that in a typical pregnancy, amniotic fluid volume increases from the first trimester to about 33 weeks of gestation, then gradually decreases before delivery. The average AFV is 700-800mL, and it decreases by 8% per week after 40 weeks in a typical

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pregnancy [6]. Fetal kidney produce urine by 8 weeks of pregnancy, and fetal swallowing follows shortly after; however, neither fetal urination nor swallowing contribute substantially to the amount of AF until the second half the pregnancy[7]. The average volume is 60ml at 12 weeks of gestation and 175ml at 16 weeks [8]. Amniotic fluid reaches a level of round about 800ml by the 28th week of pregnancy where it reaches near-term peak and then drops to about 400ml at 42 weeks [7]. Fetal kidneys produce approx. 300ml urine per day and 600 to 1200ml per day near term [8].

The amniotic fluid index (AFI) and the single deepest pocket technique (SDP) are two most frequently used ultrasound tests to estimate amniotic fluid volume. In second trimester, these two sonographic measurements are accommodating to evaluate fetal structural abnormalities most likely associated with low fluid levels or high fluid levels which can assist in making pregnancy management decisions [9]. AFI (amniotic fluid index) also acknowledged as four- quadrant analysis of AFV is done by summing up each amniotic fluid pockets [10]. It is the most common technique first proposed by Phelan in 1987, this strategy includes splitting up of the amniotic cavity into four quadrants by utilizing the maternal lineanigra as midline. A range of 5cm to 24 cm of AFI is considered as normal in Pakistan late in the 2nd and in 3rd trimester [11]. Another strategy is maximum vertical pocket (MVP), established to analyze oligohydramnios. This strategy utilized most prominent perpendicular measurement of the largest pocket of amniotic fluid which is without from any umbilical cord and any fetal extremeties. The 2 cm of the amniotic fluid is considered as the minimum normal amount whereas the amount of fluid under2 cm pointed towards oligohydramnios. The SDP or MVP is a quantitative approach that can be applied in number of pregnancies and is less time consuming and offers a rapid intervention of amniotic fluid.the SDP's AFV assessment is more reliable, as it results in fewer cesarean section deliveries as compared to AFI [10]. To acquire a precise AFI, few rules should be followed by sonographers. To the coronal plane of patient, ultrasound transducer should be placed perpendicular and the largest, unhindered amniotic fluid pocket ought to be recognized. While attaining a measurement, areas which are gray on the screen, constricted spaces between fetal structures and uterus should be evaded. If a section contains any fetal structure or loop of umbilical cord then it can't be measured [12]. For the estimation of single deepest vertical pocket, the transverse and vertical diameter of biggest pouch of the amniotic fluid should be calculated. The deepest vertical compartment of the fluid which is atleast1cm in width is considered as SDVP [13]. Diminishing in the amniotic fluid volume is known as oligohydramnios. Oligohydramnios is considered as extreme when estimation of AFI is under 5cm or SDVP is less than 2cm [14]. Polyhydramnios is characterized as large amount of amniotic fluid in a single vertical pocket with an AFI of more than 20, or more than 8cm.The incidence of polyhydramnios is approximately 1% in pregnancies. In this condition, fetal and maternal complications rate increases. In mostly cases its cause is unknown [15]. Despite of gestation period, polyhydramnios is connected with structural anomalies in fetus and antagonistic pregnancy result [6]. Excessive transducer pressure, maternal obesity, and floating particles in fluid are most common errors. Contraction of uterus and myometrium also causes an underestimation of amniotic fluid volume [15].

MATERIALS AND METHODS

The study was conducted at a radiology department of a private sector of Gujranwala, Pakistan. Data collection for the study was done from the month of August 2020 to January 2021. It's a cross-sectional and observational study. Xario and Z-5 ultrasound Doppler devices with transabdominal (3.5-5MHz) probes were used to collect data for research. A total of 100 Pakistani married female patients of various ages were included in the report. Patients in the second and third trimesters of pregnancy (14-40 weeks gestational period) were included in the study. In each patient, a supine transabdominal ultrasound was performed. The FOUR QUARDRANT METHOD and SINGLE POCKET METHOD were used to determine the amount of amniotic fluid. By drawing a horizontal and vertical line with the umbilicus as the centre point, four imaginary pockets were created. Every pocket had a probe inserted vertically in it. Color Doppler was used to ensure that each pocket was free of umbilical cord loops and fetal bits. Each quadrant's largest vertical length of each fluid pocket was measured and then adds to the others. A normal amniotic fluid index was ranged from 8.1 to 18. Oligohydramnios was defined as an amniotic fluid of less than 8.1, while polyhydramnios was defined as an amniotic fluid index of more than 18. No patient identification and each patient's details are reported separately. The patient data were used with the permission of ultrasound department at the study site. All of the information gathered during study is saved on the personal computer, and the data collection sheets are secured.

Inclusion Criteria

Women in their late second and third trimesters who were expecting a singleton had their amniotic fluid volume assessed using ultrasound as part of an antepartum fetal health assessment that linked the amniotic fluid index to the single deepest vertical pocket measurement.

Exclusion criteria

Women in their first trimester, as well as infertile women were excluded from this study.

Statistical Analysis

The data were statistically analyzed using SPSS version.

Table-1: Trimester

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**Second Trimester**	40	40.0	40.0	40.0
	Third Trimester	60	60.0	60.0	100.0
	Total	100	100.0	100.0	

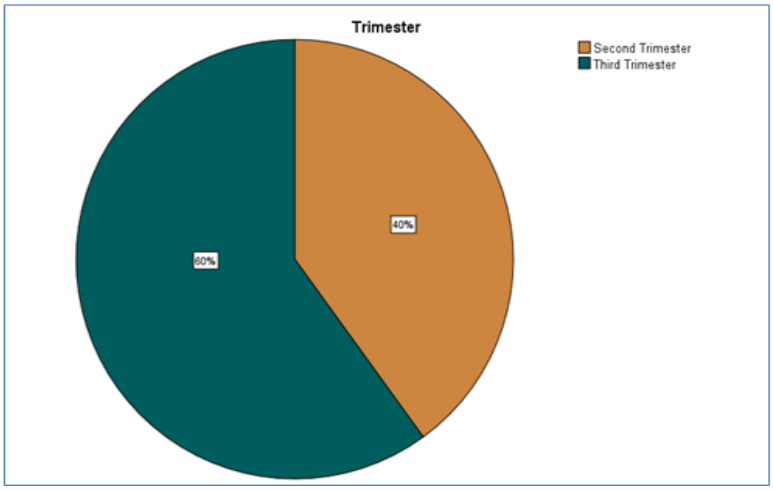

Fig-1: Distribution according to Trimesters

Table-2: AFI/MVP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**Amniotic Fluid Index**	60	60.0	60.0	60.0
	Maximum Vertical Pocket	40	40.0	40.0	100.0
	Total	100	100.0	100.0	

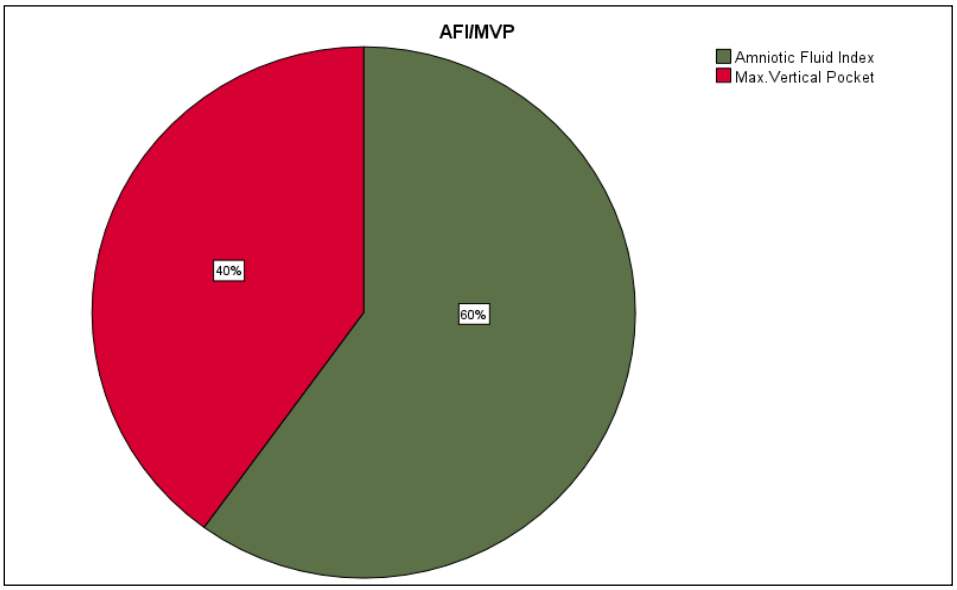

Fig-2: AFI and MVP

Table-3: Presence of either Oligohydroamnios or Polyhydroamnios

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**Oligohydroamnios**	12	12.0	12.0	12.0
	Polyhydroamnios	18	18.0	18.0	30.0
	Normal	70	70.0	70.0	100.0
	Total	100	100.0	100.0	

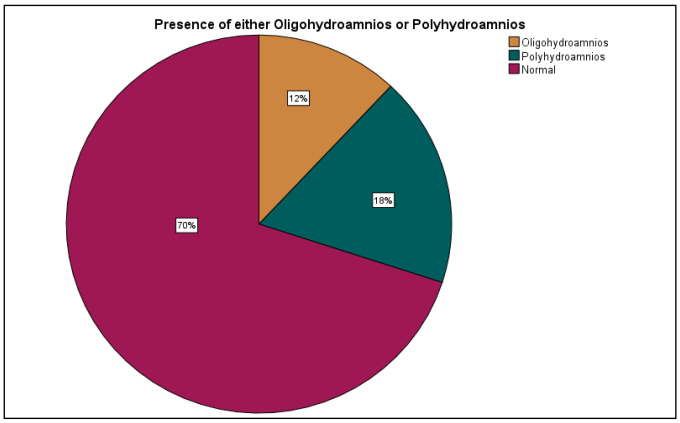

Fig-3: Oligohydramnios or Polyhydramnios

Table-4: Echo Pattern

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**Hazy AmnioticFluid**	4	4.0	4.0	4.0
	Echo free AmnioticFluid	96	96.0	96.0	100.0
	Total	100	100.0	100.0	

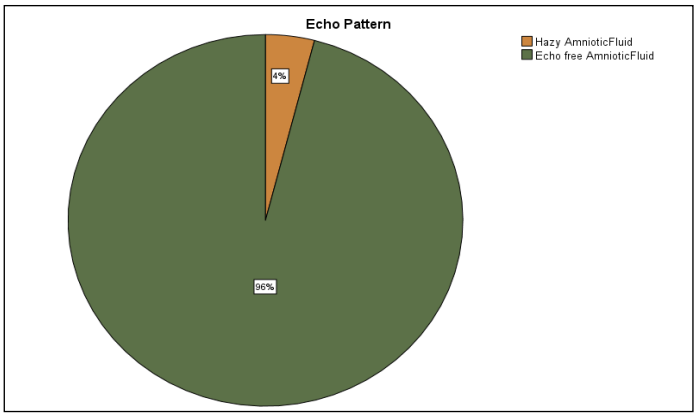

Fig-4: Echo Pattern

Table-5: Relevant Complaints

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**Low BP**	13	13.0	13.0	13.0
	High BP	2	2.0	2.0	15.0
	Diabetes	1	1.0	1.0	16.0
	No Complaint	84	84.0	84.0	100.0
	Total	100	100.0	100.0	

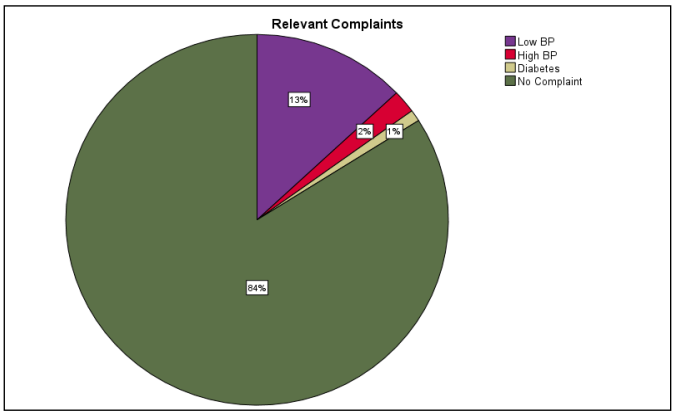

Fig-5: Distribution According to Relevant Complaints

Table-6: Statistics

		Trimester	AFI/MVP	Relevant Complaints	Presence of either Oligohydroamnios or Polyhydroamnios	Echo Pattern
N	**Valid**	100	100	100	100	100
	Missing	0	0	0	0	0
Mean		1.60	1.40	3.56	2.58	1.96
Median		2.00	1.00	4.00	3.00	2.00
Std. Deviation		0.492	0.492	1.038	0.699	0.197
Percentiles	**25**	1.00	1.00	4.00	2.00	2.00
	50	2.00	1.00	4.00	3.00	2.00
	75	2.00	2.00	4.00	3.00	2.00

RESULTS

In this analysis, the amniotic fluid volumes of 100 female patients in their second and third trimesters were measured using two sonographic techniques: the amniotic fluid index (AFI) and the maximum vertical pocket (MVP). Out of 100 female patients, 40 (40%) were in the second trimester and 60 (60%) were in the third trimester. Table 1 depicts this information. The majority of the female patients (60%) were assessed using the AFI technique, while 40 (40%) were assessed using the maximum vertical pocket technique.Table-2 illustrates this. The inclusion of oligohydramnios or polyhydramnios can be seen in Table-3. Out of 100 patients, 12 (12%) had oligohydramnios, 18 (18%) had polyhydramnios, and 70% of women had normal amniotic fluid amount. The echo pattern of the amniotic fluid volume in this study is seen in Table-4. Just 4 of every 100 pregnant women had hazy amniotic fluid; while 96 had echo-free amniotic fluid. Table-5 demonstrates that 84(84%) had no complaints about their wellbeing, 13(13%) had hypotension, 2(2%) had hypertension and just 1(1%) had diabetes. The study's overall statistics are seen in Table-6, with the AFI/MVP mean of 1.40. The mean, median, standard deviations and percentiles of the AFI/MVP, as well as relevant complaints, oligohydramnios or polyhydramnios and echo pattern are also shown in Table-6.

DISCUSSION

The amount of amniotic fluid is a good predictor of fetal health. Fetal congenital defects, post maturity syndrome, IUGR, and elevated perinatal morbidity and mortality are all linked to decreased amniotic fluid volume. The estimation of the amount of amniotic fluid has a primary part of the fetoplacental evaluation [16]. The use of ultrasound to measure AF has significant implications in obstetric care, and it has become an essential part of pregnancy evaluation [17]. Because anomalies in amniotic fluid volume are linked to a range of pregnancy complications, the AFI should be assessed in qualitatively or quantitatively at every antenatal ultrasound assessment. The single deepest pocket (SDP) and the amniotic fluid index are two ultrasound methods used to estimate the adequacy of amniotic fluid volume. Instead of the clinical significance of excessive or decreased amniotic fluid volume in pregnancy, there is little consistency in how it is measured sonographically [18]. Several studies have been conducted on comparison of AFI and SDVP as screening method for adverse pregnancy outcomes prevention**.** In a study by Mariyam Haroon et al., AFI was found to be more effective than SDVP in diagnosing women with oligohydramnios[19].

In a report by Miyamura et al., the incidence of oligohydramnios was 19% using the SDVP method and 30.5% using the AFI method [20]. The incidence of oligohydramnios was 17% by AFI method and 10% by SDVP method in another analysis by Chauhan et al. [21].

In a study by Biplab Mukhopadhyay et al., 90.0% of patients with oligohydramnios were diagnosed using AFI, compared to 46.0% in group II, where assessment was performed using the single deepest vertical pocket method[22].

In our study, we compared the results of two widely used sonographic methods for estimating amniotic fluid volume: Amniotic fluid index and maximum vertical pocket asssessment. It is a cross-sectional and observational study. When compared to MVP, AFI method was used in the majority of females in this study. The results of both methods were highly correlated. Ultrasound has been shown to be a useful diagnostic tool for a wide range of medical conditions, and its significance has grown over the last fifty years. Ultrasound is also less costly method for determining the amount of amniotic fluid in the womb. It also aids in the early detection of complications in pregnancies. The aim of this research is to develop a normative amniotic fluid index (AFI) or four quadrants amniotic fluid index scale that can be used during pregnancy in uncomplicated singleton pregnancies.

CONCLUSION

My study’s aim was to access the role of ultrasound in determining amniotic fluid volume in second and third trimesters in Pakistani population. I came to the conclusion that the AFI and the SDP are the most widely used techniques for determining amniotic

fluid adequacy. Based on it, oligohydramnios is defined as the level of amniotic fluid less than 5.5 and polyhydramnios is defined as a level of amniotic fluid greater than 22. The typical amniotic fluid index range is between 5 and 22. The SDVP less than 2cm is considered as oligohydramnios and the SDVP greater than 8cm is considered as polyhydramnios. The normal range of SDVP is between 2-8cm.

RECOMMENDATIONS

Ethical considerations

The ethical committee of the University of Lahore will set the rules and regulations for the study, and the rights of the research participants will be respected.

Confidentiality of data

All the patients signed a written informed consent form. All information gathered will be kept private and used solely for research purposes.

Informed consent and right to privacy

Patients were given the choice of withdrawing their information at any point during the data collection process. Everything is kept confidential, and everything listed in the article was done with the approval of each and every person who is mentioned in it.

Conflict of interest

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

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