



## **Incidence of Oligohydramnios – Amniotic Fluid Index (AFI) Versus Single Deepest Pocket (SDP)**

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### **Authors' contributions**

*This work was carried out in collaboration between all authors. Authors EBU and OC participated in all aspects of the study viz. designed the study, wrote the protocol, interpreted the data, anchored the field study, gathered the initial data and performed preliminary data analysis, managed the literature searches and produced the initial draft. Authors OEC and UKA managed the literature searches and produced the initial draft. All authors read and approved the final manuscript.*

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### **ABSTRACT**

**Aim:** The aim of the study is to determine the incidence of oligohydramnios using ultrasonographic assessment of the amniotic fluid and compare the incidence between AFI and SDP.

**Study Design:** A prospective cross sectional study.

**Place and Duration of Study:** Obstetrics and Gynecology department of St Elizabeth Specialist Hospital, Owerri, Imo State from January 31 to December 31, 2015.

**Methodology:** This is a prospective study involving 400 healthy women carrying uncomplicated singleton pregnancies referred to St Elizabeth Specialist, Owerri for ultrasound scanning in pregnancy from Jan 31 to Dec 31, 2015. The age of the women, gestational age based on last menstrual cycle and the parity were all taken.

With the women in the semi-Fowler position and using Moore and Cayle technique the AFI and SDP were obtained.

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Data analysis is done with IBM SPSS statistics version 21.

**Results:** Of the 400 pregnant women scanned, their age ranged from 16 years to 42 years with a mean of 27.97 years. Their gestational age from LMP ranged from 14 weeks to 41 weeks with a mean of 29.25 weeks. Seventeen of the women had an AFI <5 (oligohydramnios), which is an incidence of 4.3%, while only five had SDP <2cm, an incidence of 1.3%. The incidence of oligohydramnios was significantly ( $P=0.001$ ) higher in the third trimester with all the seventeen with AFI <5 and all the 5 with SDP <2cm occurring in the third trimester.

**Conclusion:** The AFI compared with the SDP excessively characterizes patients as having oligohydramnios.

*Keywords: Oligohydramnios; incidence; AFI; SDP.*

## 1. INTRODUCTION

The amniotic fluid volume (AFV) is regulated by several systems, including intramembranous pathway, fetal production (fetal urine and lung fluid) and uptake (fetal swallowing), and the balance of fluid movement via osmotic gradients [1].

The amniotic fluid bathes the fetus and is necessary for proper fetal growth and development. Normal amniotic fluid volume varies. Abnormal fluid volume may be a feature of a problem in the mother, the fetus, the placenta or both. For instance reduced volume of amniotic fluid, oligohydramnios, results in poor development of the lung tissue and can lead to fetal death. Oligohydramnios poses challenge to Obstetrician. It can develop in any trimester, although it is more common in third trimester [2].

Antenatal test is done to evaluate fetal health and the risk of adverse outcomes during the course of a pregnancy. [3] Thus, assessment of AFV is one of several parameters used in antenatal fetal surveillance (eg, as part of the biophysical profile or in conjunction with a nonstress test).

The diagnosis of oligohydramnios may be prompted by a lag in sequential fundal height measurements (size less than that expected for the dates) or by fetal parts that are easily palpated through the maternal abdomen [4-9].

Actual amniotic fluid volume can be measured directly at the time of operative delivery (e.g during cesarean section) or by dye-dilution techniques; however, these methods are time-consuming, invasive, and require laboratory support, thus are impractical for clinical management.

Ultrasound techniques used to estimate the adequacy of amniotic fluid volume are either qualitative/subjective (reduced, normal, increased) or quantitative/objective (eg, Single Deepest Pocket [SDP], amniotic fluid index [AFI], and the two diameter pocket, 2 by 1 cm or 2 by 2 cm pocket techniques).

Because of the existence of multiple definitions of oligohydramnios, [10-16] there is no ideal cut-off level for intervention. However, Single deepest pocket (SDP) of less than 2 cm or Amniotic fluid index (AFI) of less than 5 cm or less than the fifth percentile is generally accepted to be the lowest cut-off value to define oligohydramnios, although 8 cm has occasionally been used as a cut-off threshold for AFI. [17,18] Perinatal morbidity rates have been shown to increase sharply with SDPs below 2cm value. Miyamura et al. [18] and Myles et al. [19] have suggested that an SDP of 3.0 and 2.5 cm respectively as a better lower limit for separating normal SDPs from those consistent with oligohydramnios.

The aim of the study was to determine the incidence of oligohydramnios using ultrasonographic assessment of the amniotic fluid volume. We also compared the difference in the incidence using either AFI or SDP.

## 2. METHODOLOGY

This is a prospective study involving 400 healthy women carrying uncomplicated singleton pregnancies referred to St Elizabeth Specialist, Owerri for ultrasound scanning in pregnancy from Jan 31 to Dec 31, 2015. Those with any medical condition complicating the pregnancy like diabetes mellitus, hypertension, ultrasonographically detectable fetal anomalies, premature rupture of membranes and intrauterine growth restriction were excluded from the study. The age of the women, gestational age

based on last menstrual cycle and the parity were all taken.

The ultrasound scan is done by the first author. The ultrasound machine used is Sonoline SI 450 manufactured by Siemens Healthcare GmbH Henkestr. 127 91052 Erlangen Germany.

With the women in the semi-Fowler position and using Moore and Cayle technique the AFI and SDP were obtained. The abdomen is divided into four quadrants. Uterine quadrants were defined by the linear nigras for right and left, and the umbilicus for upper and lower sections. If the uterine fundus is  $\leq 24$  weeks, the uterus is divided into upper and lower halves by a point midway between the symphysis pubis and the top of the uterine fundus, while the linear nigras still divides it into left and right parts. Measurements of the single deepest pocket (SDP) in the uterus and the largest vertical pocket of Amniotic fluids in the four areas were taken. The summation of the largest vertical pocket of Amniotic fluids in the four areas is also done.

Data analysis is done with IBM SPSS statistics version 21.

### 3. RESULT

Out of the 400 pregnant women with uncomplicated singleton fetus scanned, their age

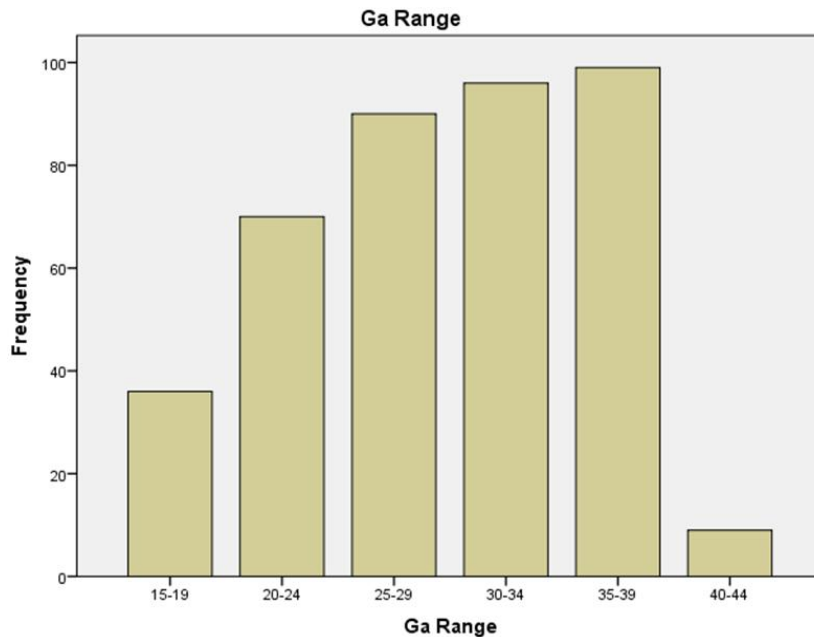
ranged from 16 - 42 years with a mean of 27.97 years. One hundred and sixty eight (42.0%) of the women were within the age range of 25-29 years. See Table 1.

**Table 1. Age group distribution of the women**

Age group (yrs)	Frequency	Percentage
Yrs	No	%
<20	12	3.0
20-24	81	20.3
25-29	168	42.0
30-34	94	23.5
35-39	41	10.3
40-44	4	1.0
Total	400	100

Their gestational age from LMP ranged from 14 - 41 weeks with a mean of 29.25 weeks. Ninety nine (24.8%) of the women were within the age range of 35-39 years. See Fig. 1.

Seventeen of the women had an AFI  $< 5$  (oligohydramnios), while five had SDP  $< 2$ cm. This gave incidences of 4.3%, and 1.3% respectively. The incidence of oligohydramnios is significantly ( $P=0.001$ ) higher in the third trimester with all the seventeen with AFI  $< 5$  and all the 5 with SDP  $< 2$ cm occurring in the third trimester with (see Table 2) the majority occurring in the gestational age range of 35-39 weeks.



**Fig. 1. Bar chart of gestational age distribution of the women**

**Table 2. Relationship between trimester of gestation and occurrence of oligohydramnios**

	Trimester			Total
	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	
SDP < 2 cm	0	0	5	5
AFI < 5 cm	0	0	17	5

The age group of 20-29 years contributed 14 (82.4%) and 3 (60%) of the women who had AFI <5 and SDP <2 cm respectively. Using AFI, 41.2% (7/17) of the cases of oligohydramnios occurred in multiparous women (Para 2-4), while is 40% in those with SDP.

#### 4. DISCUSSION

Determination of the AFI and SDP are the 2 most commonly used objective methods of determining AFV [20]. These tests are routinely performed with the patient in the supine or semi-Fowler position, although studies have demonstrated accuracy in the lateral decubitus position as well [21-26].

Reported rates of oligohydramnios are influenced by variations in diagnostic criteria, the population studied (low or high risk, screening or indicated ultrasound examination), the threshold used, and the gestational age at the time of the ultrasound examination (preterm, term, or postterm) [27].

In this series incidence of oligohydramnios ie AFI <5 and SDP were 4.3% and 1.3% respectively. This means that AFI labelled 3.3 times as many women as having oligohydramnios compared with the SDP. This is similar to other studies [27] which reported 2-3 times. It is far lower than 8 times reported by Maggan et al. [28] but far higher than the 1.2 times reported by Rosati et al. [29] In the study by Maggan EF et al., the incidence of AFI < 5cm was 8% and SDP < 2cm was 1%, while in the study by Rosati et al, the incidence of AFI <5cm was 4.47% and SDP <2cm was 3.75%. The difference between our series and other studies may be due to selection criteria. This disparity in the incidence of oligohydramnios between AFI and SDP may result in more interventions and inductions of labor and increased maternal and perinatal morbidity without any improvement in neonatal outcome. Although the SDP may be the preferred technique of estimating amniotic fluid volume, the AFI is more commonly utilized in practice.

The comparisons of the AFI and the SDP are problematic because this is a comparison of two

sonographic measurements without any objective criteria or gold standard assessment. If the comparison is truly to determine if the AFI is superior to the SDP, then both must be compared with a dye-determined technique or direct measurement of amniotic fluid volume. To this, Magann et al. [30] in 2000 estimated amniotic fluid volume by AFI and the SDP techniques among 179 patients prior to an ultrasound directed amniocentesis with dye-dilution and spectrophotometric calculation of the actual amniotic fluid volume. Using sensitivities and specificity positive and negative predictive values and likelihood ratios, no difference was noted in the AFI and the SDP to identify abnormal amniotic fluid volumes. Both techniques identified abnormal fluid volumes so poorly that they were determined to be unreliable. Other investigators have tried to correlate the AFI and the SDP measurements with dye determination (at the time of amniocentesis) or directly measured amniotic fluid volume (at the time of cesarean delivery) and have observed the poor predictive value of the AFI and SDP to predict abnormal amniotic fluid volumes (oligohydramnios or polyhydramnios) [31-34].

Randomized controlled trials and a recent meta-analysis [20,35-38] confirm these results, even if with different percentages and some confounders, factors such as high risk pregnancies and evaluation at different gestational periods (close to / at term or in the postterm period). They also found out that when the amniotic fluid index was used, significantly more cases of oligohydramnios were diagnosed, and more women had inductions of labor and cesarean delivery for fetal distress. There is no evidence that one method is superior to the other in the prevention of poor peripartum outcomes, including: admission to a neonatal intensive care unit; an umbilical artery pH of less than 7.1; the presence of meconium; an Apgar score of less than 7 at 5 minutes; or cesarean delivery.

If either of the two techniques is to be acknowledged superior to the other, it must meet most, if not all of the following criteria: (1) Accurately identify the actual amniotic fluid (analysis by dye dilution technique or direct measurement at cesarean), (2) Among uncomplicated pregnancies with reassuring outcomes, minimize the number of patients it considers to have oligohydramnios or hydramnios, (3) Is a reliable predictor of adverse

peripartum complications, and (4) When used in conjunction with other ancillary tests, it improves the neonatal outcomes [39].

However, in his evaluation of 791 pregnant women Moore [23] identified 76 (76/791=9.6%) women with oligohydramnios using the AFI measurement and 32 (32/791=4.0%) with oligohydramnios with the SDP technique. He concluded that because the AFI had identified more pregnancies with oligohydramnios than the SDP technique, it was a better predictor of oligohydramnios.

Seven subsequent nonrandomized trials have reached varying conclusions when comparing the AFI versus SDP to predict adverse pregnancy outcomes. The AFI has been reported as being the superior test by some investigators, [19,40] the SDP the superior test by another investigator [41] and neither test was superior to the other or accurately identifies perinatal complications in other investigations [42-45].

Other randomized clinical trials (RCTs) [35-38,46] compared the accuracy of identifying peripartum complications using AFI versus SDP. Three of the trials [35-37] evaluated the amniotic fluid volumes during antenatal testing and one upon admission to labor and delivery (intrapartum assessment) [46]. All four of these RCT reached the same conclusion: Compared with SDP, AFI is significantly more likely to categorize patients as having oligohydramnios, without a concomitant improvement in the perinatal outcomes. Admittedly, these four studies did not have sufficient sample size to detect a meaningful difference in peripartum complications. The fact that use of SDP leads to significantly less diagnosis of oligohydramnios and is not linked to increased morbidity is sufficient a reason to adopt it as the method to assess amniotic fluid. However other studies [20,30,45] concluded that there is no consensus as to whether AFI or SDVP is the more reproducible method for measuring AFV throughout gestation. Therefore, choice is currently on the basis of clinical preference or local protocols.

The study also showed that whatever method that is used (AFI or SDP), third trimester, age range of 20-29 and gestational age of 35-39 contributed more to the incidence of oligohydramnios. This means that whatever method (AFI or SDP) used for calculating

incidence of oligohydramnios, it is not influenced by the trimester, women's age and gestational age of the pregnancy.

## 5. CONCLUSION

In conclusion, the AFI compared with the SDP excessively characterizes patients as having oligohydramnios. This finding may lead to an increase in obstetric interventions without any documented improvement in perinatal outcome.

We therefore recommend an appropriately designed and powered study to determine the best method to evaluate the amniotic fluid volume. Until there is evidence of the objective superiority of the four quadrant summation of amniotic fluid compared with the SDP technique, we recommend abandoning the AFI in favor of the SDP.

## CONSENT AND ETHICAL APPROVAL

The study was carried out after obtaining ethical approval from the research and statistics unit of St Elizabeth's Hospital and obtaining consents from the pregnant women.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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