

OBSTETRICS

Normal Values for Amniotic Fluid Index at 26-40 Weeks' Gestation

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ABSTRACT

Objective To establish the gestational age trends of amniotic fluid index (AFI) in uncomplicated pregnancy.

Design Prospective descriptive study.

Setting Division of Maternal Fetal Medicine, Faculty of Medicine, Chulalongkorn University.

Subjects AFI was measured in 134 uncomplicated pregnancies seen between December 1996 and October 1997 and meeting the following criteria : no maternal medical or obstetric complications, normal growth of fetus by serial ultrasound. AFI was calculated by adding the deepest vertical pockets in each of four quadrants. Using the maternal umbilicus as reference, the uterus was divided into upper and lower halves. The linea nigra was then used as the midline to divide the uterus into right and left halves. The relation between gestational age and AFI was evaluated.

Results Of 134 uncomplicated pregnancies, 400 AFI measurements were performed between 26 and 40 weeks' gestation. Percentile, mean, standard deviation of the AFI were determined according to gestational ages. The relationships of AFI to gestational age were observed to be linear. The regression model could be presented as $AFI (mm.) = 226.483 - 3.0331 \times GA (week)$ ($r = 0.281$)

Conclusion Gestational age trend in normative AFI measurements for our population has been established. Gestational age-specific values of AFI should be used to define abnormal amniotic fluid conditions.

Key words : Amniotic fluid index, Ultrasound, Gestational age, Oligohydramnios

Perinatal morbidity and mortality are increased in pregnancies complicated by abnormal amniotic fluid (AFI) volume.⁽¹⁻⁵⁾ Recently, progressive improvements in ultrasonographic imaging have taken the technique of fetal and amniotic fluid assessment from the stage of subjective impression to the present state in which relatively sophisticated judgments of fetal condition can be based on reproducible measurements. Chamberlain et al observed a perinatal mortality rate of 4.12/1000 in pregnancies with polyhydramnios compared with a rate of 1.97/1000 when the amniotic fluid was normal.⁽¹⁾ The AFI was introduced as a method to quantify AFI volume sonographically in singleton gestations.⁽⁶⁾ The ultrasonic four-quadrant sum technique was first described by Phelan et al⁽⁷⁾ and termed the "amniotic fluid index". Subsequently, several investigators have reported values of the AFI for specific weeks of gestation.⁽⁶⁻⁹⁾ Normative data AFI throughout pregnancy are used in the antepartum surveillance of singleton pregnancy. The purpose of our study was to define the values of the AFI in normal pregnancy by week of gestation in our population between 26-40 weeks.

Materials and Methods

134 patients with normal pregnancies were evaluated prospectively. Normal pregnant women were recruited into the study from December 1996 to October 1997. Records were examined for gestational ages and presence of other complications. The women with medical illnesses or obstetric complications were excluded. The exclusion factors were cardiac disease, hypertension, diabetes mellitus, previous stillbirth, sonographic evidence of abnormal fetal growth, twin gestations and fetal anomalies. Gestational dating was based on the date of the last menstrual period with a confirmatory ultrasound

in the first trimester. Delivery records were examined for birth weight and Apgar scores at 1 and 5 minutes.

All AFI values from the patients meeting the entry criteria were included in this analysis. Ultrasonographic examinations were performed with an Aloka SSD 2000 (3.5 and 5 MHz) Transducer at the Division of Maternal-Fetal Medicine, Faculty of Medicine, Chulalongkorn University. All AFI measurements were conducted by single operator using the method described previously for singletons by Phelan et al.⁽⁶⁾ With the patient in the supine position, the uterus was divided into four quadrants by using the maternal umbilicus as a horizontal reference point dividing the uterus into upper and lower halves and the linea nigra as a vertical reference line dividing the uterus in to right and left halves. The transducer was placed on the maternal abdomen along a longitudinal axis, perpendicular to the floor, to identify and measure the largest AFI pocket in each quadrant. Areas with fetal small parts or umbilical cord were not measured. The number obtained from each quadrant were summed and the AFI was given in millimeters. Pockets confluent with pockets in adjacent quadrants were avoided.

Results

Between December 1996 and October 1997, after exclusions because of obstetric complications, twins and unreliable LMP, 134 were identified who underwent 400 AFI measurements in our Division of Maternal-Fetal Medicine, Department of Obstetrics and Gynaecology Chulalongkorn University.

The number of measurements at each gestational week ranged from 18 to 38 (Mean = 26) except the 40 weeks gestation which only 4 measurements were done because most of the

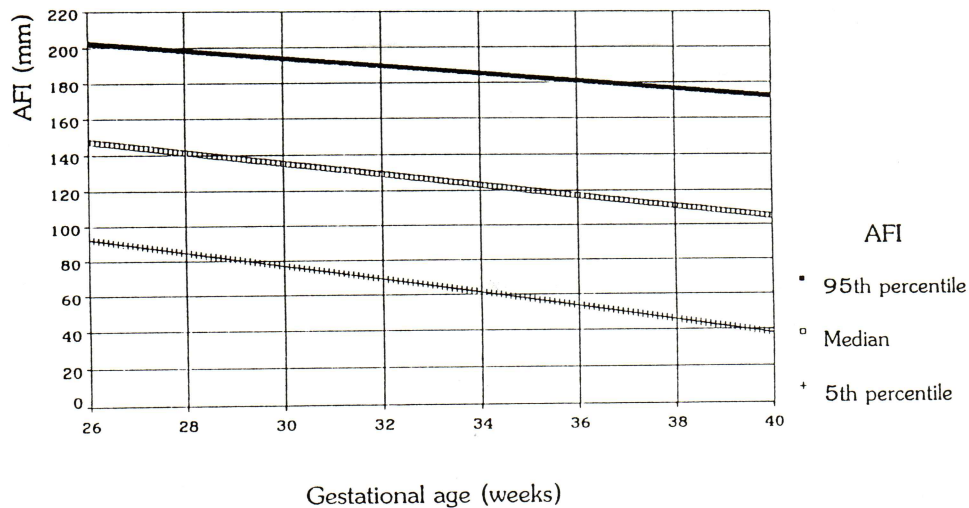


Fig. 1. Nomogram of AFI derived from regression equation. (Fig. 1.)

Table 1. Normal values of AFI (mms.).

GA (weeks)	Mean	SD	Percentile			Count
			5 th	50 th	95 th	
26	139.7	36.4	86.1	138	226.7	38
27	146.1	35.7	85.4	147	209.8	37
28	141.1	34.6	70.4	143	198	31
29	135.3	22.4	102.4	136	179.2	22
30	129.7	39.4	67.8	133	202.2	33
31	137.9	33.5	88	135	208.7	32
32	131.1	36.7	77.1	130	214.5	30
33	112.2	20.1	82.7	115	155.7	24
34	112	38.2	51	110	190	31
35	119	30.4	78.5	116	188	29
36	117	32.5	67.1	119.5	183.3	28
37	105.4	24.1	70	102	159	19
38	110.9	30.1	61	110.5	170	14
39	100.4	21.9	53	96	137	18
40	91	26.1	71	82	-	4

Table 2. Normal AFI (mms.) derived from regression equation

GA (weeks)	Percentile			SD
	5 th	50 th	95 th	
26	92.67	147.62	202.58	33.41
27	88.76	144.59	200.42	33.94
28	84.86	141.56	198.25	34.47
29	80.96	138.52	196.09	35.00
30	77.05	135.49	193.93	35.52
31	73.15	132.46	191.77	36.05
32	69.24	129.42	189.60	36.58
33	65.34	126.39	187.44	37.11
34	61.44	123.36	185.28	37.64
35	57.53	120.32	183.12	38.17
36	53.63	117.29	180.95	38.70
37	49.73	114.26	178.79	39.23
38	45.82	111.23	176.63	39.76
39	41.92	108.19	174.47	40.29
40	38.01	105.16	172.30	40.82

patients had been delivered. The results were stratified by weeks of gestation and presented with the mean, SD, 5th, 50th and 95th percentile.

A normative data of AFI for each gestational age are presented in table 1.

The relationships of AFI to gestational age were observed to be linear (Fig 1). The regression equation obtaining from random sampling of single measurement from each patient is presented as

$$\text{AFI (mm.)} = 226.483 - 3.0331 \times \text{GA (week)}$$
$$r = 0.281$$

The median, 5th and 95th centiles of AFI derived from regression equation was given in Table 2

The newborns were proved to be normal

and appropriate in size for gestational age.

Discussion

We studied 134 sets of pregnancy who underwent 400 AFI measurements between 26 and 40 weeks of gestation. We found a significant relation between AFI and gestational age.

It is important to note that all patients included in this study had uncomplicated gestation with no evidence of growth abnormalities or medical or obstetric complications. Newborn outcomes were good.

The AFI provides a semiquantitative analysis of amniotic fluid volume. The efficacy of the AFI for predicting fetal morbidity and perinatal

outcome has been proved in several studies.⁽¹⁰⁻¹⁴⁾ Patients with an abnormal AFI (< 5.0 or > 20.0 cm) have a significant increase in the incidence of major congenital malformation, perinatal mortality and complicated delivery.⁽¹⁴⁾ Phelan et al used an AFI of 5.0 cm as the lower limit of normal and 20.0 cm as the upper limit.⁽⁶⁾ Jeng defined the normal range as 8.0-24.0 cm.⁽⁹⁾ Moore and Cayle designated the 5th and 95th percentile for each gestational week as the limits of normal.⁽⁸⁾ Moore and Cayle found an increase in the AFI from 16 to 27 weeks, plateaus until 33 weeks then declines steadily into the postdate period.⁽⁸⁾ We intended to use the AFI measurement described by Phelan et al⁽⁶⁾ because we can use the maternal umbilical level as a better and more objective transverse reference line and the linea nigra as an objective vertical reference line. Moore et al⁽⁸⁾ divided the uterine cavity into 4 equal quadrants, the physician measuring the upper or lower halves will sometime find difficulty in clearly dividing adjacent upper half pocket from lower half pocket on the monitor. The reason why our study start from 26 weeks of gestation was that the Phelan's technique of AFI measurement is less objective and less reliable before 26 weeks of gestation and the chance of fetal survival is increased after 26 weeks of gestation if intervention is needed. The trend of our results was steadily declining from 26 weeks throughout pregnancy. However, our data indicated that there was a variation of AFI across gestation. In defining oligohydramnios, "alarm point", for inadequate amniotic fluid or defining polyhydramnios we would suggest the use of the 5th percentile values as screening limit for detection of oligohydramnios and 95th percentile values for detection of polyhydramnios in each week of gestation.

The AFI is an excellent noninvasive test

for estimating the amniotic fluid volume and predicting perinatal outcome. Our study determined the curve of normal values of the AFI for each gestational age and defined the 5th and 95th percentile for each gestational week between 26-40 weeks' gestation. These values may assist obstetricians in evaluating amniotic fluid volume during pregnancy in our population.

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