"Foetal Age Estimation: Using First Trimester Gestational Parameters."

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ABSTRACT:

Introduction: It is observed that the health standards of Indian adults vary widely from region to region. Similar variations are expected in the health standards of Indian babies.

Aim & Objectives: The present study aims at deriving normal values of fetal growth Parameters for ready references, in order to determine correct gestational age and to compare with other studies to demonstrate variation, if any. The Study also aims at deriving the regression equation and to demonstrate correlation between parameters.

Material & Methods: The study was carried out in 200 pregnant women in the Department of Radiology and ultrasonic equipment used was "Real Time Ultrasonography ``

First trimester parameters like Gestational Sac Diameter (GSD) and Crown Rump Length (CRL) were used. Both the parameters show linear growth as gestational age advances, they are strongly correlated with each other. Present study is comparable to other studies and there is no variation.

Results: Regression equation for GSD is $y = 0.76\ x\ -2.94$ & for CRL is $y = 0.69\ x\ -3.61$.

Conclusion: From the present study we may conclude that Usefulness of Ultrasonography as an index for the measurement of gestational age is beyond doubt.

Key words: First trimester Parameters – GSD & CRL, Gestational Age, Correlation coefficient, Regression equation.

Introduction:

Numerous tissues and organs are formed and function in perfect harmony. The most spectacular of these changes occur in the first two months during which the unborn baby acquires its main organs and just begins to be recognizable as human. During these two months we call the developing individual an embryo[1]**.** Gestational age is used synonymously with menstrual age.

The various modes of ultrasound show the returning echoes in different ways. A mode, B mode, Real time ultrasound & M mode[2]. In the first trimester, gestational sac & the embryo are the two major structures to be identified[3,4].Variations are expected in the health standards of Indian babies. Such differences are due to ethnic and socioeconomic differences in a multiracial developing country as India. Taking into consideration of the above scenario, the present topic aims at deriving normal values of fetal growth

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parameters for ready references in order to determine correct gestational age.

Materials & Methods:

The project was carried out in Radiology department with collaboration with Gynecology Department in Dr Vasantrao Pawar medical college,Nasik in the period Jan 2010 to Oct 2011. Normal pregnant females in 1st trimesters were studied by ultrasonography for estimation of gestational age of the fetus.

The study is carried in 200 pregnant women, who were chosen on the following basis - Subjects chosen were from 18-34 years of age.

A women having her first pregnancy at the age of 30 years or above was excluded from this study. In this study only normal pregnant females were selected.

Ultrasonic equipment used is "Real time ultrasonography" with linear array sector transducer.

The measurements of gestational sac diameter & crown rump length were recorded in the first trimester of pregnancy i.e. during first 12 weeks of gestation as assessed from the menstrual dates. Gestational sac parameter is the measurement of the space containing the fluid, embryo & extra embryonic structure. It is the first identified structure and is routinely identified by trans abdominal scanning as early as 5th gestational week[5, 6]. The crown rump length is the measurement of the embryo-from the vertex of the skull to the mid-point between apices of the buttock & is usually identified transabdominally at 6-7th gestational week. The CRL is measured along the longest axis[5, 7].

The data collected is thus subjected with appropriate statistical Methods.

A measurement of fetal parts during routine ultrasonography screening has been recommended. During first trimester of pregnancy GSD & CRL are the two parameters.

In this study, gestational sac is identified as early as fifth week & the embryonic CRL is identified a week later i.e., by about 6th week. This knowledge is important for pregnancy detection, particularly if medical termination is to be done in first trimester. Ultrasonography is the most reliable check on the growth of the fetus[3, 4, 5]. The present study is a cross sectional analysis of the fetal growth parameters in 200 subjects. Transabdominal ultrasonography of these subjects was performed and the measurements of the fetal growth parameters were recorded in a proforma and subjected to statistical calculations.

The mean values of the fetal growth parameters for each week so obtained were compared with those of the previously published data as follows[11, 12].

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Observations & Calculations:

Table No.1: Showing range, average & number of observations of gestational sac size from 5-12 weeks of gestation.

Gestational Age in weeks	No. of observations	Range of G.S.D in cm	Average of G.S.D In cm	S.D.
5	15	1.0 - 1.4	1.24	0.191
6	25	1.2 - 3.0	1.88	0.579
7	23	1.8 - 4.0	2.55	0.592
8	31	1.6 - 3.7	2.74	0.583
9	38	3.2 - 5.7	4.43	0.741
10	26	3.3 - 6.5	5.06	0.926
11	20	4.0 - 6.4	5.55	0.880
12	22	5.6 - 6.5	6.00	0.180

Gestational sac size measurements were recorded as early as 5th week.

The observation table shows that gestational sac size increases as gestational age advances[6].

Table No.2: Showing range, average & number of observations of Crown rump length from 6-12 weeks of gestation.

Gestational Age in weeks	No. of observations	Range of CRL in cm	Average CRL in cm	S.D.
6	25	0.4-1.3	0.76	0.299
7	23	0.5-2.8	1.19	0.567
8	31	0.6-2.2	1.47	0.514
9	38	1.8-3.0	2.39	0.333
10	26	1.9-4.5	3.52	0.934
11	20	2.5-5.7	4.62	1.260
12	22	4.8-5.7	5.30	0.296

Table No.3: showing correlation coefficient between the parameters studied.

Parameters studied	Correlation coefficient (r)
Gestational age and GSD	0.89
Gestational age and CRL	0.82
GSD and CRL	0.90

Based on the above results it is observed that all the parameters are very strongly correlated with each other so that as gestational age advances both parameters increases accordingly, in normal pregnant females.

Table No.4. Showing P value and remark.

Parameters	P value	Remark
GSD / CRL	< 0.001	Very highly significant

According to this, the correlation between 2 parameters is very highly significant.

Table No. 5: Showing regression equation for the parameters.

Parameters	Regression Equation
GSD	$y = 0.76 x - 2.94$
CRL	$y = 0.69 x - 3.61$

By regression equation of $y = 0.76 x - 2.94$, expected value of GSD at any week of gestation can be measured by putting the value of week as x and value of parameter as y.

Table No. 6: Showing gestational age estimates derived from CRL in Cms.

Gestational age in weeks	Robinson & Fleming (1975)	Drumm J.E (1976)	Present Study
6	0.68	0.40	0.76
7	1.29	1.20	1.19
8	1.87	2.00	1.47
9	2.70	2.60	2.39
10	2.60	3.60	3.52
11	4.83	4.80	4.62
12	5.37	5.20	5.30

The slight variations in the observations are negligible from the statistical point of view[11].

Table No. 7:- Showing comparison of CRL (in Cms) of the present study with the previous clinical study.

Gestational age in weeks	Streater (1921)	Scammon & calkins (1929)	Arey (1954)	Hamilton (1962)	Vare (1976)	Present Study
12	7.4	5.1	5.6	5.5	6.4	5.30

From above table, it shows that the actual CRL mean values in vivo for human fetuses lie very close to the sonar values derived in this study[13, 14].

Discussion: Estimation of gestational age by USG is high importance for diagnosis, investigation and treatment of fetus in vitro. In present study, with each fetus being measured only once the data is analyzed with gestational age as a dependent variable and equations are generated.

In the present study, it becomes evident that both parameters increase as gestational age advances. Pregnancy can be detected by ultrasonography as early as 5th week of gestational period, when the gestational sac size can be measured. The present study is also comparable to other studies carried out by Streater, Scammon and Calkins, Arey, Hamilton on aborted fetuses taking actual measurements. Thus accuracy & reliability of ultrasonographic measurement is established.

From this study it becomes obvious that GSD & CRL are strongly correlated with each other as well as are found to be statistically very highly significant. (P < 0.001) Regression Equation derived for GSD **is y = 0.76 x – 2.94** and for **CRL is y = 0.69 x – 3.61.**

From the present study we may conclude that the usefulness of Ultrasonography as an index for the measurement of gestational age is beyond doubt.

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