ISSN NO.: 2321-290X RNI : UPBIL/2013/55327 **SHRINKHALA :** VOL-1 * ISSUE-9*MAY-2014

Determination of Gestational Age by Measurements of Hand-A Morphometric Study in Human Foetuses.

Mohd Arshad
Senior Resident
Dept of Anatomy
JN Medical CollegeA.M.U.
Aligarh

Farah Ghaus
Department of Anatomy
JNMC, AMU, Aligarh.

Nazim Nasir
Assistant Professor,
King Khalid University,
ABHA, KSA

M.Tariq Zaidi
Department of Anatomy
JNMC, AMU, Aligarh.

Abstract

Determination of gestational age is important in civil and criminal cases. Though a reasonable assessment of gestational age can be made by measuring physical parameters such as crown-heel length, weight of foetus and by noting morphological features, organ development and appearance of ossification centres, an alternative parameter is desirable in some instances.

In this study we directly correlate growth of different foetal hand parameters with gestational age. 30 formalin fixed human foetuses were obtained from Museum of Department of Anatomy, Jawaharlal Nehru Medical College, Aligarh. Foetuses were divided into five groups .(Group I :<17wks), (Group II : 17-20wks), (Group III : 21-25wks), (Group IV : 26-30wks), (Group V : >30wks). We measured the seven parameters in the foetal hand i.e. length of the hand, breadth of the hand and lengths of the thumb, index finger, middle finger, ring finger and little finger. It was concluded that foetal hand, thumb and middle finger lengths are significantly correlated with gestational age and therefore these parameters could be utilized to estimate gestational age. This is justifiable useful in the medico-legal cases in which only hand or part of it is available for estimation of gestational age.

Keywords: Foetuses, Foetal hand, Gestational age, Foetal thumb, Foetal fingers,

Introduction

Accurate fetal ultrasound measurements are one of the most important factors for high quality obstetrics health care. Determination of gestational age is important in civil and criminal cases. Fetal age is usually estimated by measuring physical parameters such as crown-heel length & weight of fetus and by noting morphological features, organ development and appearance of ossification centres (1-3). Other method for evaluation of age includes fetal biometric measurements by ultrasound.

The parameters include fetal crown-rump length, biparietal diameter, head circumference, abdominal circumference, femoral length, foot length and appearance of fetal heel ossification centres (4-7). Though, a reasonable assessment of gestational age can be made by aforesaid methods,an alternative parameter is desirable in some instances, especially in cases of severe hydrocephalus, anencephaly, short limb dysplasia, post-mortem destruction or in mutilated cases. Although ultrasound measurements by specialists are also quite precise but the quality of the measurements are user-dependent and time consuming.If these are done directly on the fetus, it holds more accuracy and reliability. Kumar et al(9) showed that the fetal hand and foot has a characteristic pattern of normal growth. These authors proposed that the fetal hand and foot length could be utilized to estimate gestational age.

In this paper we present a direct method of fetal measurements that targets the accurate and robust detection of different important parameters of fetal hand that are difficult to measure by other techniques as ultrasound i.e., length of the hand, breath, Breadth of the hand, lengths of thumb, index finger, middle finger, ring finger and little finger of human fetus. Our method can handle previously unsolved issues in the domain of fetal ultrasound imaging. The approach was designed to be absolutely manual, so that user does not need to provide any initial guess or approximation as by ultrasound method. The only inputs to the system are the aborted fetuses and measuring instrument. The data can provide a reference point for other methods of fetal hand measurement of fetal hand for estimation of gestational age.

Material And Method

30 formalin fixed human fetuses were obtained from Museum of Department of Anatomy Jawaharlal Nehru Medical College at Aligarh. Institutional ethics committee has no objection on doing research work on these fetuses. Fetuses were divided into five groups (I to V) shown in table 1.

Groups	Gestational age (weeks of intrauterine life)	Number of fetuses
I	< 17 weeks	06
II	17-20 weeks	06
III	21-25 weeks	06
IV	26-30 weeks	06
V	>30 weeks	06

Following measurements were taken with the help of vernier callipers to nearest of millimetre.

1. Hand length of human foetus.
2. Breadth of hand of human foetus.
3. Length of thumb of human foetus
4. Length of index finger of foetus
5. Length of middle finger of the foetus
6. Length of the ring finger in foetus.
7. Length of the little finger in foetus.

Each reading was taken three times and the mean of the same was considered to avoid human error. Values were statistically analyzed by using ANOVA test with the help of SPSS software. Graphs were also plotted for readings to determine the pattern of growth and their correlations with gestational age if any.

Observation

It is very clear from figure 1 that the growth of length of hand in fetus is more or less steady throughout except it is maximum between IV and V group. It implies that determination of fetal age is more easy and significant in this group. In figure 2 the breadth of hand shows steady growth but minimum growth in b/w I and II group. Similarly in figure 3 the length shows steady growth with gestational age. Whereas the length of index finger shows constant growth with slight less during 15 -18 weeks as depicted by figure 4. In figure 5 constant growth in length of middle finger is seen in whole gestation. Length of ring finger grows with a constant speed except during I to II as shown by figure 6. Whereas figure 7 shows maximum growth in length of little finger in late gestation.

Table-1; Hand Length of Human fetus

Group	Mean±SD (mm)	Percent increase	Pvalue < .05
I	17.16 ±1.94	----------	
II	21.16 ±2.85	23.31	NS
III	31.83 ±3.60	50.42	S
IV	39.50 ±5.50	24.09	S
V	52.83±6.55	33.74	S

Table-2; Breadth of Hand of Human fetus.

Group	Mean ± SD (mm)	Percent increase	p value <.05
I	9 ± 0.89	----------	
II	11.5 ± 1.04	27.77	S
III	18 ± 2.44	56.52	S
IV	24.5 ± 4.84	36.11	S
V	29 ± 3.84	18.36	NS

Table-3; Length of thumb of human fetus.

Group	Mean ± SD (mm)	Percent increase	p value <.05
I	8.83 ± 0.98	---------	
II	11 ± 2.60	24.57	NS
III	14.33 ± 2.50	30.27	NS
IV	19.16 ± 2.63	33.70	S
V	22.33 ± 3.14	16.54	NS

Table-4; Length of index finger of fetus.

Group	Mean ± SD (mm)	Percent increase	p value <.05
I	10 ± 1.09	----------	
II	12 ± 1.09	20	S
III	17 ± 2.36	41.66	S
IV	21.66 ± 2.16	27.41	S
V	27.66 ± 4.84	27.70	S

Table-5; Length of middle finger of the fetus.

Group	Mean ± SD (mm)	Percent increase	p value < .05
I	10.5 ±1.37	----------	
II	13 ±1.67	23.80	NS
III	18.83 ±1.94	44.84	S
IV	24 ±3.16	27.45	S
V	31.5 ±4.59	31.25	S

Table-6; Length of the ring finger in fetus.

Group	Mean ± SD (mm)	Percent increase	p value <.05
I	10 ±1.54	----------	
II	11.66 ± 1.86	16.6	NS
III	17 ± 1.78	45.79	S
IV	22.5 ± 3.01	32.35	S
V	29.5± 4.03	31.11	S

Table-7; Length of the little finger in fetus.

Group	Mean ± SD (mm)	Percent increase	p value <.5
I	8 ± 1.41	-------	
II	9.33 ± .81	16.6	NS
III	13 ± 1.67	39.33	S
IV	18.16 ± 2.40	39.69	S
V	24.66 ± 3.93	35.79	S

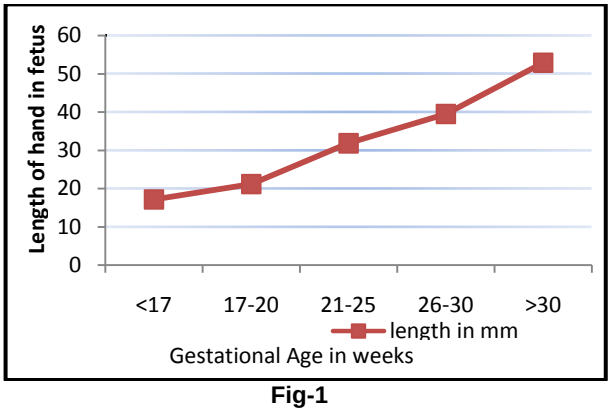

Fig-1

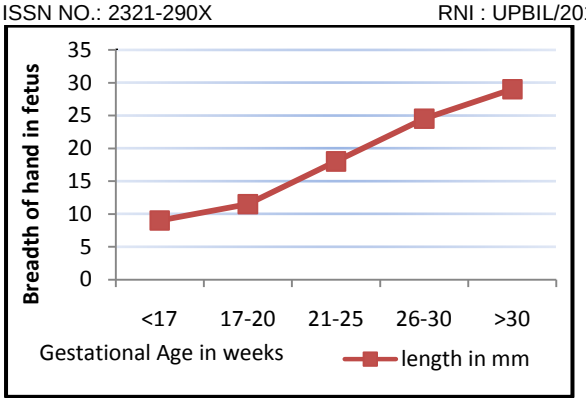

Fig-2

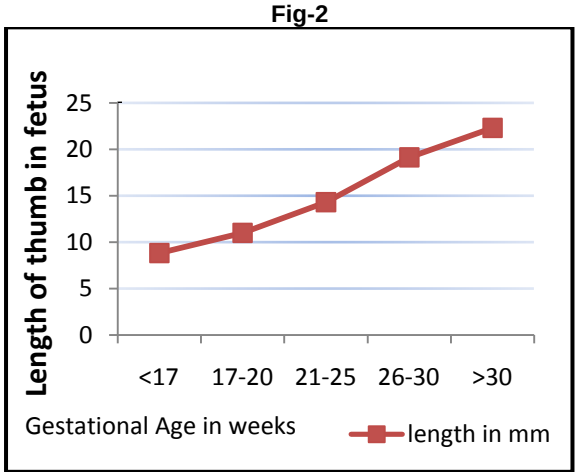

Fig-3

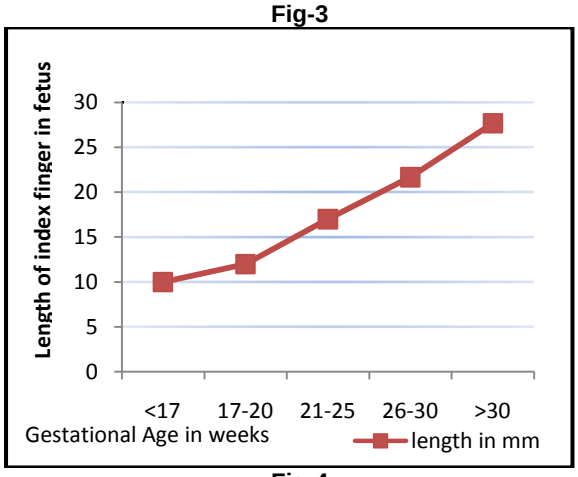

Fig-4

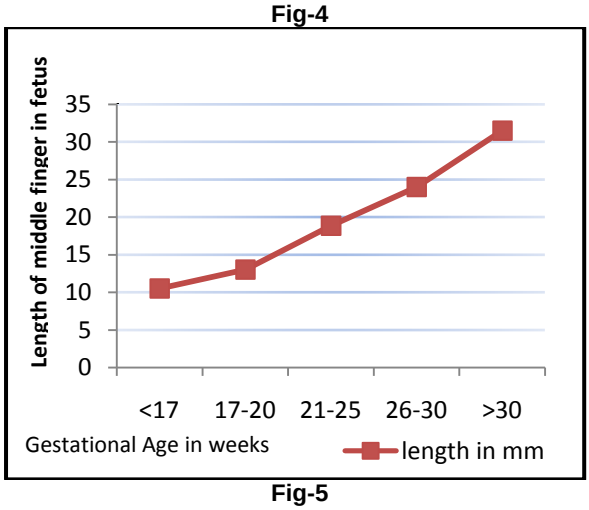

Fig-5

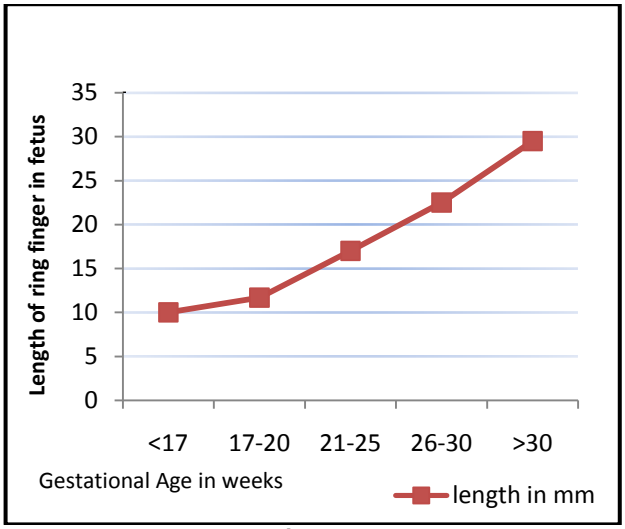

Fig-6

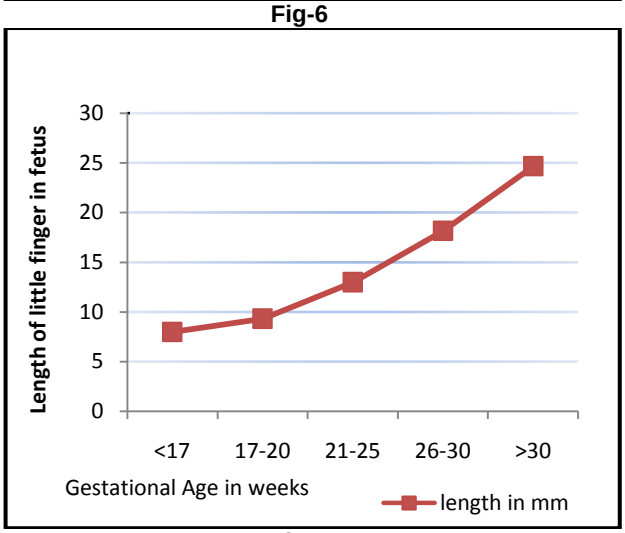

Fig-7

Discussion

Obstetricians have been using the fetal foot length to estimate gestational age. The period of gestation by this method appears to be in agreement with other ultrasound parameters (6, 7). The result of our prospective study provides normative data on fetal hand and growth throughout the gestation. The data of present study is in accordance with those of Kumar et al(9). Fetal hand and foot lengths have been found to highly correlate with gestational age and therefore these parameters could be utilized to estimate gestational age.

The utilization of fetal hand measurements will serve as a useful adjunct data for estimation of age in reliable manner. Moreover, it's utility becomes apparent when other parameters of fetus cannot be utilized dueto disease, deformity or destruction by injury or post-mortem process or mutilation. Apart from estimation of gestational age, the utilities of foot length measurements have been shown by other studies. Pospisilova-Zuzakora (10)used foot length to determine body length of fetus whereas a study conducted by Embleton et al (11), concluded that foot length of fetus is a reliable and reproducible predictor of nasotracheal tube length, especially in premature babies.

Conclusion

It was concluded that fetal hand, thumb and middle finger lengths are highly correlated with gestational age and therefore these parameters could be utilized to estimate gestational age. It is also of use in the medicolegal cases in which only hand or part of it, is available available for estimation of gestational age.

References

1. Dorovini-zis K, Dolman C. Gestational development of brain. Arch Path Lab Med 1977 ; 101 : 192-5.
2. Kumar K U, Pillay V V. Estimation of fetal age by histological study of kidney. Med Sci Law 1996 ; 36 : 226-30.
3. Piercecchi-Martin M D, Adalian P, Liprandi A, Figarella-Branger D, Dutour O, Leonetti G. Fetal visceral maturation: a useful contribution to gestational age estimation inhuman foetuses. J Forensic Sci 2004; 49: 912-7.
4. Bovicelli L, Orsini L F, Rizzo N, Calderoni P, Pazzaglia F L, Michelacci L. Estimation of gestational age during the first trimester by real-time measurement of fetal crown-rump length and biparietal diameter. J Clin Ultrasound 1981 ; 9 : 71-5.
5. Reece E A, Scioscia A L, Green J, O'Connor T Z , Hobbins J C. Embryonic trunk circumference : a new biometric parameter for estimation of gestational age. Am J Obstet Gynecol 1987 ; 156 : 713-5.
6. Mercer B M , Sklar S, Shariatmadar A, Gillieson M S, D'Alton M E. Fetal foot length as a predictor of gestational age. Am J Obstet Gynecol. 1987; 156 : 350
7. Goldstein I, Reece E A, Hobbins J C. Sonographic appearance of the fetal heel ossification centers and foot length measurements provide independent markers for gestational age estimation. Am J Obstet Gynecol 1988; 159: 923.
8. Rajesh Bardale at el. Indian Journal of Forensic Medicine and Pathology. April -June, 2008, 1: 249
9. Kumar G P, Kumar U K. Estimation of gestational age from hand and foot length. Med Sci Law 1993; 33: 48-50.
10. Pospisilova-Zuzakora V. Determination of the body length of fetus with the aid of the length of the sole of the foot. Biologia 1962 ; 17 : 49-52.
11. Embleton N D, Deshpande S A, Scott D, Wright C, Milligan D W A. Foot length, an accurate predictor of nasotracheal tube length in neonates. Arch Dis Child Fetal Neonatal Ed. 2001; 85 : 60-4.
12. Chalana .V, Winter II.T, Cyr .D, Haynor.D, Kim.Y, Automatic fetal head measurements from sonographic images. Acad Radiology1956 ; 3 (8) : 628-635.
13. Friedman.J, Hastie.T, and Tibshirani.R, Additive logistic regression: a statistical view of boosting. Annals of Statistics 2000 , 28 (2) : 337-374 .
14. Hanna.C, and Youssef.A, Automated measurements in obstetric ultrasound images. ICIP. 1997; [10]; 504–507.
15. Jardim.S, and Figueiredo.M, Segmentation of fetal ultrasound images Ultrasound in Medicince and Biology 2005; 31 (2) : 243-250.
16. Pathak.S.D., Chalana.V, and Kim.Y, Interactive automatic fetal head measure-ments from ultrasound images using multimedia computer technology. Ultrasound in Medicine and Biology 1997; 23 (5) : 665-673.
17. Schluter.P.J., Pritchard.G, and Gill.M.A, Ultrasonic fetal size measurements in Brisbane, Australia. Australasian Radiology 2004 ; 48 (4) : 480-486.