



“DETERMINATION OF GESTATIONAL AGE BASED ON FETAL MEASUREMENT AND FETAL WEIGHT”

***Dr. Rajeev Mukhia**

Lecturer, Department of Anatomy, Manipal College of Medical Sciences, Pokhara, Nepal. *Corresponding Author

Mr. Phanindra Prasad Poudel

Assistant Professor, Department of Anatomy, Manipal College of Medical Sciences, Pokhara, Nepal.

ABSTRACT

There are several anatomical parameters which are useful in the determination of gestational age. Estimation of gestational age of human foetuses is of great medico-legal importance. The present study aims to determine the gestational age of human foetuses using crown rump length and crown heel length and also to estimate the ratio between body weight and gestational age. After permission from the Institutional Ethical Committee the foetuses were collected from Manipal College of Medical Sciences Teaching Hospital, Pokhara. The measurement, crown heel length and crown rump length was measured on foetuses and the weight of the foetuses was also calibrated. The crown rump length, crown heel length and weight of foetuses increase with the increase in gestational age. The knowledge of measurement of crown rump length and crown heel length on human foetuses is helpful in anatomy, forensic medicine, foetopathology and paediatrics.

KEYWORDS : Human foetuses, Crown rump length, Crown heel length, Foetal weight.

INTRODUCTION

Gestational age is a measure of the age of a pregnancy. It is not the same as fertilization age. It takes about 14 days from the first day of the last menstrual period for conception to take place and thus for the conceptus to form. The age from this point in time (conception) is called the fertilization age and is thus 2 weeks shorter than the gestational age. Thus a 6 week gestational age would be a 4 week fertilization age. An average gestational period (duration of pregnancy from the first day of the last menstrual period up to delivery) is 280 days. On average, this is 9 months and 6 days.¹ Accurate estimation of gestational age is important in obstetric care. Knowledge of accurate prediction of gestational age may assist obstetricians in appropriately counselling women who are at risk of a preterm delivery about likely neonatal outcomes and is also essential in the evaluation of fetal growth and the detection of intrauterine growth restriction.²

Estimation of gestational age of foetus is of great medico-legal importance.³ It is of extreme importance in supporting the charge of infanticide by knowing that whether the baby born was alive and had a separate existence from the mother and that a wilful act of commission or omission caused its death.⁴ Various physical parameters like foot length, hand length, head circumference, biparietal diameter, chest circumference, abdominal circumference, femur length, weight and appearance of ossification centres has been utilized for the estimation of gestational age.⁵ In addition, accurate fetal age estimation is very important in obstetric and pediatric clinical practice.⁶ The present study was carried out, to help the investigating authorities to solve legal problems in relation to foetuses. Main objectives of the present study were to estimate gestational age of human foetuses using crown heel length and crown rump length and also to estimate the ratio between body weight and gestational age.

MATERIALS AND METHODS

The present study was carried out on 40 normal human foetuses, aged between 10th to 38th gestational weeks. The normal foetuses were obtained from the Department of Obstetrics and Gynaecology, Manipal College of Medical Sciences Teaching Hospital, Fulbari, Pokhara. After ethical review and permission from the concerned authorities of the Institute, the foetuses were collected in 10% formalin for carrying the present study. The foetuses included the spontaneous abortion and still born foetuses. Cases with any anomaly or pathology were not included in the study. The age of foetuses was calculated from the obstetrical history, crown rump length (CRL) and crown heel length (CHL).

Crown heel length was taken by placing foetus in supine position with all limbs extended and measurement taken from the crown of the head to the heel in foetuses with foot held in vertical position while Crown rump length was measured by placing foetus in prone position with all

limbs extended and measurement taken from the top of the head (crown) to the bottom of the buttocks (rump). The measurements were taken with the help of thread, measuring scale and vernier calliper in millimetres. The weight of foetuses was calibrated in grams by electronic digital weighing machine. All the measurements were taken thrice and the average value was taken.

OBSERVATIONS AND RESULTS

The present study was carried out in the Department of Anatomy, Manipal College of Medical Sciences, Pokhara, from March 2017 to August 2017. Total 40 human foetuses ranging from 10th to 38th weeks were studied. To estimate the gestational age, the following parameters were studied.

1. Crown rump length (CRL)
2. Crown heel length (CHL)
3. Foetal weight (FW)

The results of average crown rump length, crown heel length and foetal weight is shown in Table 1.



Figure 1: Foetuses of different gestational ages kept on table for measuring CRL and CHL.



Figure 2: Measuring foetal weight, Crown rump length (CRL) and Crown heel length (CHL) of foetuses.

Table 1: Mean Crown heel length (CHL), Crown rump length (CRL) and Foetal/Body weight at different gestational ages (GA).

GA (in weeks)	No. of foetuses	CHL (in mm)	CRL (in mm)	Body weight in gm
10	2	70	55	10.01
12	3	110	85	12.20
14	2	162	118	69.25
16	3	171	129	100.00
18	2	206	158	197.60
20	3	247	182	319.25
22	4	285	207	435.40
24	3	316	234	630.00
26	3	350	245	766.80
28	2	386	265	1019.50
30	3	402	267	1360.00
32	2	416	294	1558.00
34	2	445	317	1925.00
36	3	470	331	2324.00
38	3	515	355	3101.60

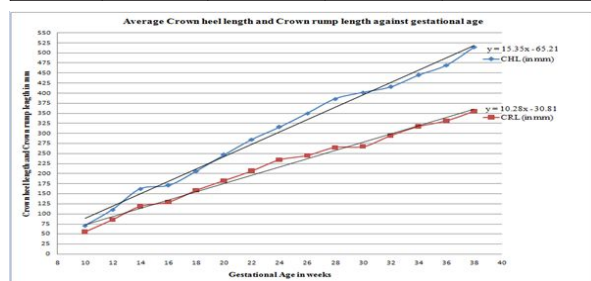


Figure 3: Scatter diagram showing linear co-relationship of Crown heel length (CHL) and Crown rump length (CRL) against gestational ages (GA).

DISCUSSION

Gestational age estimated by crown heel length in the present study coincide with that of Archie J.G *et al*, 2006, Davinson S *et al*, 2008, Aryal DR *et al*, 2012.⁷⁻⁹ Similarly, fetal age estimation using crown rump length in the present study is in agreement well with that of Merlob P *et al*, 1986,¹⁰ Archie J.G *et al*, 2006,⁸, while it is less compared to the findings obtained from the study of Hadlock et al, 1982.¹¹ Streeter GL 1920, has mentioned foot length only as an additional control for the determination of the foetal age. He related the disadvantage of the foot length as compared with the crown rump length in the analysis of the age because being smaller than crown rump length; foot length would have a smaller weekly increment.¹² However, Usher and McLean 1969, have used foot length measurement in classification of postpartum infants.¹³ Mercer BM *et al*, 1987, foot length was considered as a predictor of age in special clinical cases from ultrasonographic measurement.¹⁴

Increase in fetal weight is a good indicator of fetal growth in general. Rate of weight gain during 1st, 2nd, and 3rd trimester differs considerably. In the present study the body weight of foetuses showed gradual increase from 10th to 38th weeks of gestation. These findings were compared with the findings of others researchers and was in agreement well with that of Keith Moore (2008)¹⁵, while it is less compared to the findings obtained from the study of Hamilton (1972)¹⁶ and Bocian (1993)¹⁷.

CONCLUSION

In the normally developing foetuses the crown heel length, crown rump length and foetal weight increases with advancing gestational age. These parameters have shown a significant correlation with gestational age and these parameters are the best parameters for determining gestational age in the first, second and third trimester and should be used by researchers because these methods are simple to perform and less time consuming. The knowledge of measurement of crown heel length, crown rump length on human foetuses is helpful in anatomy, forensic medicine, foeto-pathology, obstetrics and

pediatrics. Accurate prediction of gestational age is very important in the management of high risk pregnancies in order to prevent premature deliveries. On comparing the results of the present study with that of previous researchers, we concluded that the present study is in agreement with that of some previous studies, while some findings were deviating owing to the difference in amount of data and population, sample size of study, genetic and environmental factors which affects the foetal development and interfere with the accurate age estimation to the particular area studied.

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REFERENCES

- Ohuma EO, Papageorghiou AT, Villar J, Altman DG 2013, Estimation of gestational age in early pregnancy from crown-rump length when gestational age range is truncated: the case study of the INTERGROWTH-21st Project, BMC Med Res Methodol 13, 151.
- Kalish RB, Chervenak F 2009, Sonographic Determination of Gestational Age. Timisoara Medical Journal, 2, 395.
- Castellana C. Kosa F 1999, Morphology of the cervical vertebrae in the fetal-neonatal human skeleton. Journal of anatomy, 194, 147-152.
- Kumar GP, Kumar UK 1993, Estimation of gestational age from hand and foot length, Medicine, science and law, Vol.33, No.4, 48-50.
- Bardale R., Sonar V 2008, Assessment of Gestational Age from Hand and Foot Length. Indian Journal of Forensic Medicine and Pathology, April - June, Vol.1, No.2, 47-51.
- Alexander G. R., Tompkins M. E., Cornely D. A. 1990, Gestational Age Reporting and Preterm Delivery, Public Health Reports, Vol. 105, No. 3, 269-275.
- Archie J.G., Collins J.S., Lebel R.R. 2006, Quantitative Standards for Fetal and Neonatal Am J Clin Pathol, 126, 256-265.
- Davidson S., Sokolover N., Erlich A., Litwin A., Linder N., Sirota L 2008, New and Improved Israeli Reference of Birth Weight, Birth Length, and Head Circumference by Gestational Age: A Hospital-Based Study, IMAJ 10, 130-134.
- Aryal DR, Gurung R, Misra S, Khanal P, Pradhan A, Gurubacharya SM Intraute 2012, Growth Curves for Singleton Live Babies in Paropakar Maternity and Women' Hospital in Nepal. J Nepal Health Res Counc, Jan;10(20), 160-6
- Merlob P, Sivan Y. and Reiser S.H 1986, Ratio of crown rump distance to total length in preterm and term infants, Journal of Medical Genetics, 23, 338-340.
- Hadlock FP., Deter RL., Harrist RB. and Park SK. Fetal abdominal circumference as a predictor of menstrual age. American Journal of Roentgenology. 1982; 139: 367-370.
- Streeter GL 1920, Weight, sitting height, head size, foot length, and menstrual age for the human embryo, Contrib Embryol, 11, 143.
- Usher RL, McLean F. 1969. Intrauterine growth of live-born Caucasian infants born at sea level: standards obtained from measurements in 7 dimensions of infants born between 25 and 44 weeks of gestation, J Pediatr 74, 901-935.
- Mercer Bm, Sklar S, shariatmandar A, Gillieson MS, D'Alton ME 1987, Fetal foot length as a predictor of gestational age. Am J Obstet gynecol, 156, 350-355.
- Moore LK and Persaud TVN. The foetal period Ninth week to birth. Chapter 6: The developing Human Clinically Oriented Embryology. 8th edition, Philadelphia, Elsevier. 2008; 96.
- Hamilton WJ and Boyd JD. Growth of embryo and foetus, development of external form, estimation of embryonic and foetal ages: Human Embryology. 4th edition, Heffer Cambridge. 1972; 175.
- Bocian-Sobkowaka J., Malendowicz LK and Wozniak T. Weight of organs of foetuses. Histopath. 1993.