

INTRODUCTION

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Medicine is an ever changing science. We could not have seen a caterpillar turning to butterfly unless there would have been a change. Hence, Sir George Bernard Shaw rightly said, "Change is the only constant thing in the World."

Anatomy, long viewed as a complex catalog of structure is changing its attitude by leaning towards the philosophy which takes it beyond what is regarded as science. From scalp to sole, every anatomical structure needs philosophical introspection for the betterment of medical science. During embryogenesis the three layered (ectoderm, endoderm and mesoderm) embryonic disk folds on itself to an embryonic cylinder which undergoes some invaginations and evaginations to give shape to a complex and complete individual. In this regard, all morphogenic processes during the period of embryogenesis may be regarded as variants of behavior of a fertilised ovum.

The philosophisation of anatomy in this new millennium will tune it to a celestial song. Anatomy is the foundation on which the towering edifice of clinical medicine is built up. It is the only branch of medical science which deals with human being before birth and after death.

Now-a-days, the study of anatomy is a better integrated subject with which clinical science tunes in harmony like a synthesizer. Anatomy today continues to extend its way over every speciality of medicine.

It is now a common practice to precede the word anatomy with an adjective that defines the angle of observation e.g. Developmental Anatomy; Radiological Anatomy; Surgical Anatomy etc. The study of Anatomy gets a momentum when it is interpreted with the help of modern imaging systems like Ultrasonography (USG), Computed tomography (CT), Magnetic Resonance Imaging (MRI) and conventional Radiology. Radiographic Anatomy may be considered as a wing of various aspect of study of Anatomy in details.

Assessment of gestational age has become very important in each and every pregnancy for observation of proper fetal growth and development and also its ultimate outcome.

In previous days, assessment of gestational age was done on the basis of menstrual history and clinical examination (e.g. fundal height estimation, maternal weight gain etc.) and there was no imaging technique for assessment of gestational age.

Previously X-ray was used to detect mainly intrauterine fetal death and abdominal pregnancy. Unfortunately in X-Ray and CT scan, exposure to radiation during the period of organogenesis and development of fetus very frequently leads to congenital anomaly of the fetus. So, not recommended during pregnancy.

Similarly use of MRI needs absence of any movement for a period of half to one hour for producing image and data acquisition, though, recently some highly sophisticated procedure for MR(Magnetic Resonance) scan has been developed on moving object (e.g. Cardiac MR scan) but not

easily applicable in all purposes. Normal fetal movement during MR (Magnetic Resonance) Scan hampers data acquisition. Hence, proper image production is not possible by MRI during pregnancy. Moreover, the safety of MRI in pregnancy has not yet been established. So, of all the currently available imaging techniques ultrasonography is the only non-invasive, non-ionising, non-hazardous, high accuracy, safe, cost effective, reproducible and easy available method for assessment of gestational age and fetal well-being.

In the year 1958, Sir Ian Donald (an Obstetrician) and his colleagues in Royal Maternity Hospital at Glasgow, first applied principle of ultrasound in obstetrics, which was considered as one of most important step in the field of diagnostic imaging. In 1959 Professor Ian Donald discovered that clear echoes could be obtained from the fetal head and he started to apply this information for diagnosing the size and growth of the fetus at the Royal Maternity Hospital Rotternrow. Within next few years it became gradually possible to monitor the pregnancy sonologically from beginning to end including assessment of gestational age and diagnosis of various complications like twin pregnancy, fetal abnormality, placenta praevia etc.

In the past, Obstetricians had to compromise with many untoward incidences in prenatal, parital and postnatal periods due to lack of prior information regarding abnormality in uterine and adnaexal anatomy and feto-placental profile. High maternal and fetal morbidity and mortality rate was a global problem at that time. So, sonographic evaluation of antenatal mother became essential in every pregnancy. It is done for

confirmation of pregnancy, fetal viability and number, evaluation of fetal growth, fetal presentation, estimation of gestational age with known and unknown LMP(first day of last menstrual period), verification of EDD(expected date of delivery), evaluation of molar pregnancy and ectopic pregnancy at any stage, evaluation of placental maturity, position and abnormalities, umbilical cord, amniotic fluid volume, assessment of congenital anomaly of the fetus, detection of causes of hemorrhage in pregnancy, congenital anomaly of uterus and associated uterine and ovarian pathology, assessment of fetal growth in successful in vitro fertilization, selection of cases for elective cesarean section and deciding cases of elective termination of pregnancy etc.

For assessment of gestational age presently used conventional fetal biometric parameters are Crown Rump Length (CRL), Biparietal diameter (BPD), Head circumference (HC), Abdominal circumference (AC) and Femoral length (FL). Among these parameters CRL is measured (done only in first trimester of pregnancy) with an accuracy of ± 0.5 weeks. It is found that CRL is till the best parameter for determination of accurate gestational age during the first trimester. In subsequent trimesters CRL becomes fallacious as the fetus turns to fold after 1st trimester and so, it is not applicable for accurate estimation of gestational age after 1st trimester of pregnancy. In 2nd and 3rd trimester other biometric parameters like BPD, HC, AC, FL etc. which are commonly used (average of all the parameters) for fetal age determination, vary in accuracy by ± 1.2 to 3.5 weeks approximately. Variation of measurements of

Head circumference (HC) is ± 1.2 to ± 1.9 weeks, Biparietal diameter (BPD) is ± 1.2 to ± 1.9 weeks, Femoral length (FL) ± 2.1 to 3.5 weeks (Ref. Carol M. Rumack, *et al*, in "Diagnostic Ultrasound" Vol. 2, Second Edition, Chapter 33; 1997; Page 1021). In case of measurement of Abdominal circumference (AC) it is done mainly to determine fetal weight measurement with the help of other biometric parameters and its individual variation is so high, it is not used as single parameter for estimation of gestational age. Moreover all of these parameters have limitations of application and naturally cannot be applied at any condition of pregnancy e.g. when head has engaged, BPD and HC cannot be measured and estimation of gestational age has to be done only on FL and AC which itself varies in a wider range.

Other than conventionally used fetal biometric parameters few more fetal parts/organs like bi-ocular distance, cerebellar diameter, length of humerus, foot length, talus length, kidney length etc are being tried for accurate estimation of gestational age. Of these fetal kidney length estimation for gestational age determination is comparatively measured more accurately and can be employed at any point of time during pregnancy. The process of determination of gestational age by fetal kidney length measurement has been done by many researchers and still it is under extensive research trial throughout the various countries. In 1983, Bertagnoli L, Lalatta F, *et al* [6]. of Ultrasound School of Obstetrics and Gynecology, Italy, showed in their study that there was no significant difference between right and left fetal renal length and measurements of fetal

kidney can be used as an additional parameter in the routine assessment of fetal well being and gestational age. In the year 1991, HL Cohen, J Cooper, Eisenberg P, et al. [26] of North Shore University Hospital Cornell University Medical College, Manhasset, made a study on renal length and its correlation with gestational age and results showed that fetal renal lengths were longer than previously reported. In 1997, Saha M, Paul AK *et al* [54] of Nuclear Medicine Centre, Khulna, Bangladesh, did an ultrasonographic study in normal pregnancies between 16 and 40 weeks of gestation. Their study showed an excellent correlation between gestational age, biparietal diameter, femoral length and renal length measurements and the average kidney length at full term was 3.95 cm. In 1997, Carol M. Rumack, Stephanie R. Wilson, *et al*, in their highly esteemed text book "Diagnostic Ultrasound" Vol. 2, Second Edition, 1997, Chapter 37, Page 1094, mentioned the often quoted rule of thumb is that "renal length in millimeters approximates gestational age in weeks". [13]

In the year 2002, Konje J C, Abrams KR. *et al*. [35] of UK mentioned in their study that fetal kidney measurement was easy to make and could therefore be easily incorporated into the model for dating pregnancies after 24 weeks of gestation, in particular when measurements of the biparietal diameter and head circumference are difficult. In the year 2006, Slobodan Vljaković, Ljiljana Vasović, *et al*, [59] Department of Anatomy, Faculty of Medicine, University of Niš, Niš, Serbia and Montenegro, mentioned in their study, the importance of

determining the average fetal kidney dimensions, which could be used as standard values in obstetrics.

Hence a trial has been done to search for a new biometric parameter like fetal kidney length measurement to determine the gestational age more accurately which can be employed at any point of time during pregnancy for estimation of gestational age, as it is not affected by the factors like ruptured membranes, engagement of head, lie and presentation of the fetus etc. Moreover in advanced pregnancy cases where there is no information regarding first day of last menstrual period (L.M.P), sonography was not performed during the early weeks of pregnancy, fetal kidney length measurement may play a vital role in determination of gestational age. This effort may be treated as a tribute to the betterment of service to the suffering humanity in the reproductive medicine for betterment of perinatal care by exact assessment of gestational age and timely medical intervention to reduce the perinatal morbidity and mortality.