Accuracy of Foetal Scapular Length for Ultrasonographic Estimation of Gestational Age

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ABSTRACT

Introduction: The foetal scapula begins to ossify at 8 weeks of gestational age and is easily, consistently visible on ultrasound which is very helpful in accurate estimation of gestational age and hence in the management of pregnancies including high risk cases so the study was done to determine the correlation between foetal scapular length and gestational age

Materials and methods: A prospective observational study was conducted on 207 women aged between 18 to 35 years with normal singleton pregnancies, over a duration of 5 months from August 2016 to December 2016 at AMC MET Medical College and LG Hospital, Maninagar, Ahmedabad, Gujarat state. Gestational age and foetal scapular length was determined using Ultrasound machine GE LOGIQ P5, using a 4 MHz curvilinear transducer. Data was analyzed using tests correlation and simple linear regression etc. using SPSS version 21.0 software (IBM).

Results: Pearson's correlation coefficient value of 0.985 and regression coefficient 0.1 noted between gestational age and foetal scapular length with a significance $p < 0.001$.

Conclusion: Foetal scapular length shows a positive correlation with foetal gestational age and hence it is a very useful and accurate parameter for ultrasonographic assessment of foetal gestational age.

Keywords: Correlation, Regression Coefficient, Fetal Scapular Length, Gestational Age

INTRODUCTION

An accurate estimation of foetal gestational age is essential in clinical interpretation and successful management of all pregnancies especially in high risk cases like pre-eclampsia, eclampsia, gestational diabetes mellitus, central placenta praevia, Rh incompatibility, intrauterine growth retardation and chronic renal disease to reduce perinatal mortality and morbidity. The expected date of delivery estimated based on last menstrual period has its own limitations like false menstrual history, pregnancy during lactational amenorrhoea, first trimester bleeding per vagina and irregular menstrual cycle, leading to false calculations.[1] Clinical judgement of symphysio-fundal height is not always accurate due to conditions like gestational diabetes mellitus, multiple gestation, intrauterine growth retardation and transverse foetal lie.[2] Among the various biometric indices for foetal gestational age assessment by ultrasound, most commonly used is Hadlock based composite gestational age assessment from biparietal diameter (BPD), abdominal circumference (AC) and femur length (FL). The above mentioned Hadlock based foetal biometric indices show variable results in cases of breech presentation, engaged head, macrosomia and congenital anomalies. The scapula is easily visualized on ultrasound since its ossification begins at 8 weeks of gestational age and is almost ossified at birth.[3] With this background, the present study was done to determine

the correlation between foetal scapular length and gestational age, to determine its regression coefficient with respect to gestational age and to compare it with other standard biometric foetal indices for gestational age assessment.

MATERIAL AND METHODS

A prospective study was conducted at AMC MET Medical College and LG Hospital, Maninagar, among 207 women with normal singleton pregnancies, whose gestational age were confirmed by early ultrasound, over a study period of five months from August 2016 to December 2016, using the criteria established by Jeanty.[4] Study was approved by institutional ethical committee and consent was obtained from all study participants. Singleton uncomplicated pregnancies with no known structural or chromosomal anomalies and with gestational ages from 15 to 36 weeks were included in this study. Ultrasound was performed on GE LOGIQ P5 machine using a 4 MHz curvilinear transducer. The average gestational age was determined using Hadlock's formula from foetal biometric indices like, abdominal circumference (AC), femur length (FL) and bi-parietal diameter (BPD). Scapular length of all foetuses was measured on a sagittal section from acromion process of scapula to inferior angle of scapula as end point (Figure 1). Standard sagittal section of measurement was ensured by taking spinous process of scapula as third reference point, which appeared in the dorsal aspect of scapula.[4] Scapular length was measured by fixing electronic calipers at the two end points on the sagittal section showing the reference points. Three measurements were taken in centimeter and its average was calculated and recorded for data analysis. The scapula nearest to the probe was measured.

Pregnancies with oligohydramnios or polyhydramnios were excluded. Also, pregnancies having chromosomal and congenital anomalies like amelia, complete or partial duplication of scapula, scapular neck dysplasia, Sprengel's deformity, sickle shaped scapulae in Pierre Robin syndrome,[3] were excluded. Other exclusion criteria included multiple pregnancies, maternal
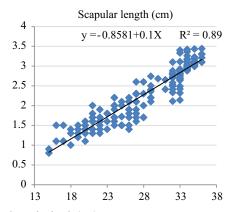
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International Journal of Contemporary Medical Research
ISSN (Online): 2393-915X; (Print): 2454-7379 | ICV (2015): 77.83 | Volume 4 | Issue 5 | May 2017

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Figure-1: Sagittal ultrasound scan of foetus showing scapular length of 1.55 cm, measured from tip of acromion process to inferior angle of scapula, corresponding to 19 weeks of gestational age. End points of measurement are shown as plus (+) sign of electronic calipers.

Figure-2: Scatter plot between dependent variable scapula length(Y) and independent variable gestation age (X)
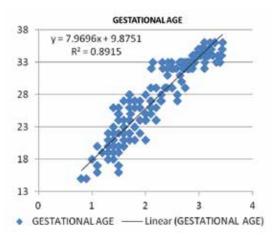

Figure-3: Scatter plot between dependent variable gestation age (Y) and independent variable scapula length (X)

obesity, gestational diabetes mellitus and pre-eclampsia.

STATISTICAL ANALYSIS

The data obtained were analyzed using SPSS version 21.0 software (IBM). The scapular length was analyzed as the dependent variable paired with gestational age. Linear Pearson's correlation and regression coefficient was calculated between gestational age and scapular length as well as between gestational age and other foetal biometric indices. Significance level was considered at p value <0.05.

RESULTS

Ultrasonographic measurements of 207 healthy pregnant women were taken and linear relationships were obtained between scapular length and gestational age. The mean scapular length was 2.27 ± 0.69 cm with a range of 0.8 to 3.44 cm. Pearson's correlation between gestational ages determined by Hadlock formula with the foetal scapula length was found. There was a positive correlation between mean scapular length and gestational age determined from Hadlock based BPD, FL and AC (p< 0.001). This relationship was positively correlated with Pearson's correlation coefficient value of 0.940 and a significance of p < 0.001. An extremely strong correlation of gestational age was obtained with variables like scapular length (r = 0.940), BPD (r =0.966), FL (r = 0.978) and AC (r = 0.752). Scatter plots were drawn between gestational age (independent variable) and scapula length (dependent variable) to depict linear regression equation and intercept (Figure 2). Regression coefficient of scapula is 0.1. There is also reciprocal linear regression between scapula length (independent variable) and gestational age (dependent variable) as shown in Figure 3.The linear regression equation of scapular length (cm) as a function of gestational age (weeks) is SL= - 0.8581 + 0.1 (GA). The linear regression equation of gestational age (weeks) as a function of scapular length (cm) is GA= 9.8751 + 7.9696 (SL).

DISCUSSION

The foetal scapula can be indentified consistently on ultrasonography. The foetal scapula is visualized easily on USG, no matter what the foetal position is, and hence it is a reproducible plane of measurement.[5] Estimation of an accurate gestational age is very important for management of pregnancies. It has been stressed upon since long for foetal biometric indices, which are easy to calculate with accurate interpretation and are easily reproducible. The ossification of scapula starts at 8 weeks of gestational age and is almost completed by birth.[6] With evolution, the supraspinatous fossa became smaller whereas the infraspinatous fossa became larger due to changes in shoulder elevator muscle force couples.[7] This study will be useful in cases of engaged foetal head, where it is difficult to measure foetal bi parietal diameter as well as in cases of intrauterine growth retardation, macrosomia and

Study	Linear regression equation	Intercept	Regression coefficient	p value	R 2
Present study	Y= -0.858+0.1X	-0.858	0.1	<0.001	0.89
Sherer DM et al[5]	Y= 0.3289 + 0.9553 X	0.3289	0.9553	<0.001	0.942
Murao et al[8]	Y= 0.3455 + 0.6847X	0.3455	0.6847	<0.001	0.90
Kashi nath et al[9]	Y= -0.48+ 0.1X	-0.48	0.1	<0.001	0.971
Table-1: Comparison of intercept and regression coefficient of linear regression equation of scapula length (Y) with gestational age (X) between present and past studies					

malformation where abdominal circumference measurement gives false values. In above enlisted clinical conditions, the measurement of foetal scapular length will give an accurate, reproducible estimation of foetal gestational age. We compared the intercept and regression coefficient between previous and present studies as illustrated in table 1. In present study done on 207 pregnant mothers. we got a linear regression equation of scapular length (cm) as a function of gestational age (weeks) as SL= - 0.8581 + 0.1 (GA) as compared to Sherer DM et al[5] with a linear regression equation of Y= 0.3289 + 0.9553 X, Murao et al[8] with equation of Y= 0.3455 + 0.6847X, Kashi nath et al[9] with equation of Y= -0.48+ 0.1X. Our study showed comparatively stronger correlation between gestational age and scapular length in comparison to both the studies of Sherer DM et al[5] and Murao et al[8] done previously as shown in Table 1. Our results were consistent with study done by Kashi nath et al.[9] In future, an accurate average gestational age can be estimated by taking all biometric indices into consideration including scapular length.

CONCLUSION

In our study, there is a positive correlation between mean scapular length (dependent variable) and gestational age (independent variable) with $p< 0.001$ and Pearson's correlation coefficient value of 0.940 with significance of $p < 0.001$. There is also reciprocal linear regression between scapular length (independent variable) and gestational age (dependent variable) with $p < 0.001$.

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International Journal of Contemporary Medical Research
ISSN (Online): 2393-915X; (Print): 2454-7379 | ICV (2015): 77.83 | Volume 4 | Issue 5 | May 2017

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