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Original Research Article

Correlation of Gestational Age and Fetal Sacral Length: Study in a Specialized Hospital

Dr. Salma Shahnawaz Parvin[1*], Dr. Md. Ahsan Habib[2], Dr. Maksuda Khatun[1], Dr. Md. Towrit Reza[1], Dr. Md. Saiful Haque[3]

[1]Assistant Professor, Department of Radiology and Imaging, Bangabandhu Sheikh Mujib Medical College, Faridpur, Bangladesh
[2]Senior Consultant, Department of Surgery, 250 Bed Madaripur Sadar Hospital, Madaripur, Bangladesh
[3]Associate Professor, Department of Radiology, Diabetic Association Medical College, Faridpur, Bangladesh

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***Corresponding author:** Dr. Salma Shahnawaz Parvin
Assistant Professor, Department of Radiology and Imaging, Bangabandhu Sheikh Mujib Medical College, Faridpur, Bangladesh

Abstract

Introduction: To choose whether to end the pregnancy and how to deliver the baby, obstetricians require a precise estimation of gestational age. Other criteria can be useful when inaccurate menstrual history cannot be utilized to estimate gestational age. One such element is the fetal sacral length, which may be measured using ultrasound. Numerous criteria have been utilized in conjunction with ultrasonography to estimate gestational age. However, only the first and second trimesters of pregnancy are when all of these metrics are trustworthy. They become less accurate as the pregnancy goes on for a number of reasons, with the third trimester having the most fluctuation at around 3 to 3.5 weeks. ***Methods:*** A total of 200 pregnant women participated in this prospective observational study at the Department of Radiology and Imaging, Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorders. The research was carried out between January 2001 and December 2002. ***Result:*** The participants' average age was 24.54 years. Only 3% of the participants were in the oldest age range of 36-40 years, with 38 percent of the participants being between the ages of 21 and 25. The average height of the participants was 150-154 cm in 52 percent of the cases. The mean SD height and weight were 152.40±3.44 cm and 54.80±4.45 kg, respectively. There is a strong positive relationship between fetal sacral length and gestational age, according to BPD and FL. The relationship between gestational age and fetal sacral length was demonstrated to be statistically significant. There was no statistically significant relationship between fetal sacral length and maternal height. ***Conclusion:*** Fetal sacral length and gestational age are closely connected. Sacral length can be used consistently as an extra metric during pregnancy in conjunction with other established parameters if it is assessed precisely with a high-resolution ultrasound scanner.

Keywords: Ultrasound, Sonography, Gestationa.

INTRODUCTION

For the greatest obstetric treatment, the ability to calculate gestational age is essential. All individuals who provide care for pregnant women have the issue of accurately estimating the gestational age, particularly in high-risk pregnancies where early termination is advised. The inconsistency of clinical indicators makes it challenging to deliver adequate prenatal care. Thanks to recent developments in diagnostic imaging, fetal age and growth may now be estimated with a high degree of precision [1]. The gestational age can be calculated using clinical, radiographic, or ultrasonographic methods of dating [2]. An incorrect gestational age raises the risk of iatrogenic premature birth before the fetus is viable. On the other side, if the gestational age is unknown, the baby may die in the uterus after term as well as all the problems associated with post-term pregnancy. By determining the gestational age, abnormalities in fetal development like large- for-date or intrauterine growth retardation are also identified. Growth asymmetry or symmetry is also determined by a number of fetal factors. Before ultrasonography was available, the gestational age was calculated by obstetricians by recalling the first day of the subject's last period and using clinical indicators such fetal height, fetal heart sound, and impression of the first quickening. This technique of calculating gestational

age may be erroneous due to poor recall, variation in menstrual cycle length, implantation hemorrhage, and use of oral contraceptives within three months after conception, or conception while breastfeeding [3]. A new age in obstetrics has begun with the invention of ultrasonography. It is essential for figuring the gestational age. Obstetric ultrasonography now includes the assessment of gestational age as a critical component. The method is based on measurements of fetal body parts. Any metric that varies as the gestational age increases can be utilized in ultrasonography to calculate the gestational age [4]. To calculate gestational age, a number of measurements are frequently utilized, including the femoral length, head circumference, belly circumference, biparietal diameter, and gestational sac diameter (GSD) [5]. The first trimester is when GSD and CRL are used, but the second and third trimesters are when other medications utilized. During the first and second trimesters of pregnancy, there is a small range of variation in the accuracy of gestational age prediction. These measures become less accurate as the pregnancy goes on since every metric in the third trimester is influenced by a variety of circumstances. In the third trimester, there are no single fetal characteristics that may be used to calculate gestational age. The composite age dating approach, which uses many criteria to lessen variability, is advised for all pregnancies that are more than 20 weeks along [6]. A non-invasive, affordable, straightforward, and generally accessible procedure is ultrasonography. A number of fetal osseous structures' ultrasound measures have been connected to gestational age. For the purpose of diagnosing both typical and aberrant fetal development as well as skeletal abnormalities, measurements for BPD, HC, and FL have been created. There has also been research on other prenatal organic structures. A research on kidney length discovered a significant relationship between gestational age and kidney length [7-9]. The goal of this study was to evaluate fetal sacral length in different gestational periods to consider it as a new parameter for determining gestational age throughout pregnancy when the mother's LMP is unknown or other routine methods produce contradictory results.

OBJECTIVE

General Objective

- To determine the normal length of the fetal sacrum at different ages of gestation throughout pregnancy.

Specific Objectives

- To observe the correlation between gestational age and fetal sacral length.

METHODS

The Department of Radiology and Imaging at the Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine, and Metabolic Disorders conducted this prospective observational study. From January 2001 to December 2002, the study lasted two years. For the purposes of this study, 200 pregnant women with apparently normal fetuses, aged 15 to 40 weeks, were referred to the radiology and imaging department of the study hospital. Consecutive sample selection was carried out in accordance with the study's inclusion and exclusion criteria. Initially, all subjects were evaluated using a detailed history and clinical examinations, with a focus on obstetrics. The fetal sacral length was measured via ultrasonography, and gestational age was calculated using Biparietal Diameter (BPD), Femur Length (FL), and an average of these two measurements. The parameters were related to gestational age, which was calculated based on the last menstrual period (LMP). A link was discovered between gestational age and fetal sacral length. Each participant provided informed written consent, and the study hospital's ethical review committee granted ethical approval.

Inclusion Criteria

- Women with a normal pregnancy with reliable LMP.
- Regular menstrual history.
- Early-onset of perinatal care.
- Complete visualization of the sacrum.
- Patients who had given consent to participate in the study.

Exclusion Criteria

- Multiple pregnancies.
- Oligo and polyhydramnios.
- Intra-uterine growth retardation.
- Exclude those affected with other chronic diseases etc.

RESULTS

The mean age of the participants was 24.5±4.48 years. 38% of the participants were aged between 21-25 years, and only 3% of participants were from the oldest age group of 36-40 years. 52% of the participants had a height between 150-154 cm. The Mean ± SD height was 152.40±3.44 cm, and the Mean ± SD weight was 54.80±4.45 kg. Fetal sacral length and gestational age were found to have a strong positive correlation as predicted by BPD and FL. The correlation between gestational age and mean fetal sacral length was found to be highly significant. There was no statistically significant relationship between fetal sacral length and maternal height observed.

Table 1: Physical Characteristics distribution of the participants (n=200)

Characteristics	Frequency	Percentage (%)	Mean age ± SD (years)
Age in years			
16-20	40	20	24.5±4.48
21-25	76	38	
26-30	58	29	
31-35	20	10	
36-40	6	3	
Height in cm			
<150	40	20%	152.40±3.44
150	104	52%	
>154	56	28%	
Weight in KG			
45-49	18	9	54.80±4.45
50-54	80	40	
55-59	82	41	
60-64	12	4	
>64	8	4	

This study involved 100 percent of women between 15 to 40 weeks of gestation. The age range was from 16 to 40 years and the mean age of the participants was 24.5±4.48 years. 38% of the participants were aged between 21-25 years, and only 3% of participants were from the oldest age group of 36-40 years. Out of the 200 subjects, most of the participants (52%) belonged to the 150-154 cm height group, followed by 28% from the height group of >154cm, and the remaining belonging to <150 cm (20%). The mean height of the subjects was 152.40 ± 3.44 cm. Among the participants, the majority (41%) were from the weight group of 55-59 kg, while 40% weighed 50-54 kg. 9% of the participants had very low weight, between 45-49 kg, 4% had weight between 60-64 kg, and the remaining % weighed over 64 kg.

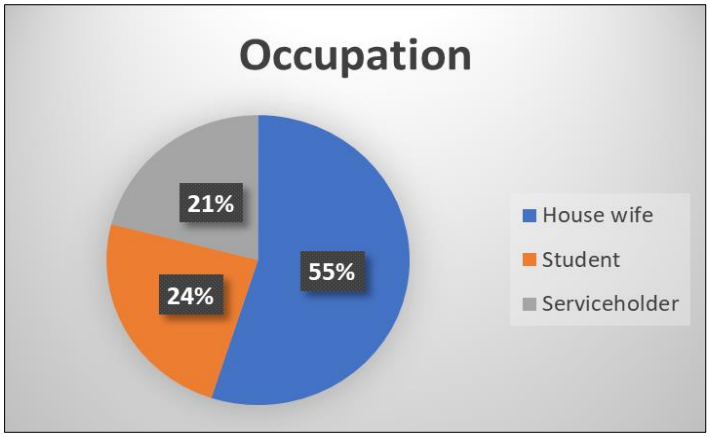

Figure 1: Occupation distribution of subjects (N=200)

Over half (55%) of the participants were housewives, while 24% were students and 21% were service holders.

Table 2: Relationship of fetal sacral length with gestational age as predicted by BPD, FL, and average of these two

Predicted Gestational Age	Fetal sacral length (mm)	
	Number	*P*-Value
predicted by BPD	200	<0.001
predicted by FL	200	<0.001
predicted by an average of BPD & FL	200	<0.001

The sacral length was presented in millimeters and gestational age was expressed in weeks. A strong positive correlation was found between fetal sacral length and gestational age as predicted by BPD and FL. These results had high statistical significance ($p<0.001$).

Table 3: Mean fetal sacral length at various gestational age (15-40 weeks) (n=200)

Gestational age(weeks)	Number of observation(n)	Mean ± SD fetal sacral length(mm)	95%Confidence interval	
			Lower	Upper
15	12	14 ±0.89	13	15
16	10	15 ± 0.81	14	16
17	6	16 ±.61	15	17
18	8	17 ±0.84	16	181
19	10	181 ±0.84	17	19
20	10	19 ±0.81	181	20
21	10	20 ±0.81	19	21
22	8	21 ±0.84	20	22
23	8	22 ±0.92	21	23
24	8	23 ±0.92	22	24
25	6	24 ±0.89	23	25
26	10	25 ±0.88	24	26
27	6	26 ±0.89	25	27
28	8	27 ±0.92	26	28
29	6	28 ±0.89	27	29
30	6	29 ±0.63	28	30
31	10	31 ±0.94	29	33
32	6	32 ±0.77	30	34
33	6	33 ±0.64	31	35
34	6	34 ±0.63	32	36
35	8	35 ±0.84	33	37
36	6	36 ±0.77	34	38
37	8	37 ±0.75	35	39
38	6	38 ±0. 63	36	40
39	6	39 ±0.63	37	41
40	6	40 ±0.77	38	42

The observed values were grouped according to gestational age determined by an average of BPD and FL. Mean fetal sacral length, their standard deviation, and 95% confidence intervals were presented for each week of gestation. The fetal sacral length increases linearly corresponding to gestational age from a mean of 14 mm ± 0.89 SD at 15 weeks to 40 mm ± 0.77 SD at 40 weeks of gestation. The relationship between gestational age and the mean fetal sacral length was highly significant ($p<0.001$)

Table 4: Relation of fetal sacral length with maternal height and weight (n=200)

Variables	Number	Pearson's Correlation	*P*-Value
Maternal height	200	.64	>0.05
Maternal weight	200	.07	>0.05

There was no statistically significant correlation observed between the fetal sacral length with maternal height ($r=0.64$, $p>0.05$) or with maternal weight ($r=0.07$, $p>0.05$)

DISCUSSION

A crucial aspect of the screening sonographic examination is the assessment of the fetal spine. For an early diagnosis of embryonic spinal abnormalities, a precise measurement of the normal fetal sacrum is required. The goal of this study was to establish a relationship between fetal sacral length and gestational age in order to find a new, accurate criterion for measuring gestational age throughout pregnancy. As the pregnancy goes on, the fetal sacral length increases. On ultrasound, the sacrum looks to be ossifying by week 15 of pregnancy [10]. The last five vertebral bodies have ossified, leaving the fetal sacrum clearly visible in the longitudinal segment of the fetal spine. The sacrum serves as a proxy for these caudal-most vertebral bodies since the coccyx ossifies after birth. The third trimester is when the sacrum is easiest to measure, and the coccyx differs from the ossified sacrum in terms of echogenicity. Poor scans may be caused by a technical issue or maternal obesity, which will prevent the sacrum from being seen. The ambiguity of the sacral endpoints, particularly the lower one if it is covered by limb bones, continues to prevent precise measurements. These issues cropped up in a few instances as well. In this prospective research, 200 pregnant women between the ages of 15 and 40 weeks participated. The fetuses' sacral lengths were gauged in millimeters. Five vertebrae at the caudal end were counted. The results of the present investigation are in agreement with those of earlier studies that discovered a significant relationship between fetal sacral length and gestational age. We established a considerable positive link between the anticipated fetal sacral length and gestational age by BPD, as well as the average of these two. The mean length of the fetal sacrum expanded linearly from 14

mm at 15 weeks to 40 mm at 40 weeks. Neither the length of the sacrum nor the weight of the mother was correlated with one another. Karabulut *et al*, compared the data obtained by ultrasonography and dissection to determine the value of prenatal ultrasonographic measurements of the sacrum as a predictor of in utero development and gestational age [11]. 186 pregnant women between the ages of 14 and 40 weeks participated in a prospective research. Their research revealed a linear relationship between sacral length and gestational age, FL, and BPD (r =.93, .93, and .93 respectively). Additionally, they examined 101 spontaneously aborted babies between the ages of 13 and 39 weeks, and discovered that the sacral bones they retrieved during dissection matched those of an ultrasonogram [11].

Limitations of the Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

The Fetal sacral length is well related to gestational age. If sacral length is measured accurately with a high- resolution ultrasound scanner, it can be used reliably as an additional parameter throughout pregnancy in conjunction with other established parameters.

FUNDING

No funding sources.

CONFLICT OF INTEREST

None declared.

ETHICAL APPROVAL

The study was approved by the Institutional Ethics Committee.

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