PERINATAL JOURNAL

Research Article

Perinatal Journal 2014;22(1):28-32

Comparison of the consistency between sonographic and clinical weeks of gestation at first trimester according to genders

Rahime Nida Ergin[1], Murat Yayla[2]

[1]Department of Gynecology & Obstetrics, Medicine Faculty, Bahçeşehir University, Istanbul, Turkey
[2]Gynecology & Obstetrics Clinic, International Hospital, Istanbul, Turkey

Abstract

Objective: It was aimed to compare the consistency according to genders between clinical weeks of gestation and weeks of gestation calculated based on crown-rump length (CRL) found ultrasonographically at $11^{0/7}$-$13^{6/7}$ weeks in singleton pregnancies.

Methods: The study included 868 spontaneous singleton pregnancies retrospectively who had first trimester screening test between 2004 and 2012, without any anatomic anomaly, had gender determination, and with known last menstrual period (LMP). They were evaluated in 3 different groups as -1 /+1 day, -2 -7 / +2 +7 days and below -8 / above +8 days which represent [clinical gestational week – ultrasonographic gestational week according to CRL]. Female and male fetuses were compared in terms of the differences found.

Results: Mean maternal age was found as 30.2±4.0 and mean week of gestation was 12.6 ± 0.6. In terms of the difference groups in male and female genders, it was found for [clinical gestational week – ultrasonographic gestational week according to CRL] that the accuracy rate of CRL for detecting week of gestation was 94% for males with 7 days of deviation, and it was 94.6% for females (p>0.005).

Conclusion: There is a high rate of consistency between first trimester CRL measurements and clinical weeks of gestation calculated with ±7 days of deviation. Genders had no impact on this rate.

Key words: Calculation, fetus, first trimester, gender, screening, ultrasonography, week of gestation.

Birinci trimester sonografik ve klinik gebelik haftası uyumunun cinsiyetlere göre karşılaştırılması

Amaç: Tekil gebeliklerde $11^{0/7}$–$13^{6/7}$ haftalar arasında yapılan ultrasonografik değerlendirmede baş-popo mesafesi (CRL) temel alınarak hesaplanan gebelik haftası ile klinik gebelik haftasının uyumunun cinsiyetlere göre karşılaştırılması amaçlandı.

Yöntem: Retrospektif olarak 2004–2012 yılları arasında birinci trimester taraması yapılmış olan, anatomik anomalisi bulunmayan, cinsiyet tayini yapılmış ve son adet tarihi bilinen 868 spontan tekil gebelik değerlendirmeye alındı. [Klinik gebelik haftası – CRL'ye göre ultrasonografik gebelik haftası] olarak ifade edilen fark -1 /+1 gün; -2 -7 / +2 +7 gün ve -8 altı / +8 üzeri gün olarak 3 ayrı grupta değerlendirildi. Kız ve erkek fetüsler bulunan fark açısından karşılaştırıldı.

Bulgular: Ortalama anne yaşı 30.2±4.0 ve ortalama gebelik haftası 12.6±0.6 olarak saptandı. Erkek ve kız cinsiyetindeki fark grupları değerlendirildiğinde [klinik gebelik haftası - CRL'ye göre ultrasonografik gebelik haftası], erkek cinsiyette 7 günlük sapma payı ile CRL'nin gebelik tarihini saptama doğruluğu %94; kızlarda ise bu oranın %94.6 olduğu görüldü (p>0.005).

Sonuç: Birinci trimester CRL ölçümleri ile ±7 gün sapma payında hesaplanan klinik gebelik haftası arasında yüksek oranda uyumluluk mevcuttur. Cinsiyetin bu oran üzerinde herhangi bir etkisi yoktur.

Anahtar sözcükler: Birinci trimester, fetüs, cinsiyet, ultrasonografi, tarama, gebelik haftası, hesaplama.

Introduction

Accuracy of gestation time used for pregnancy follow-up is significant for the health of mother and baby. Although LMP and calculations based on clinical evaluations are used, they may be inconsistent with each other.[1] As shown in a society-based cohort study, nega-

Correspondence: Rahime Nida Ergin, MD. Bahçeşehir Üniversitesi Tıp Fakültesi Kadın Hastalıkları ve Doğum Anabilim Dalı, İstanbul, Turkey.
e-mail: drnidaergin@gmail.com

Received: October 17, 2013; **Accepted:** November 25, 2013

Available online at:
www.perinataljournal.com/20140221006
doi:10.2399/prn.14.0221006
QR (Quick Response) Code:

tive impacts of conditions such as prematurity may date back to 5-year-old childhood period; therefore, accurate determination of fetal age and accurate term time are significant.[2] Many parameters such as maternal age or educational level have been asserted as the cause of inconsistencies among calculation methods.[3-10] It has been reported that CRL measurement to be conducted between 8 and 16 weeks of gestation would give the most accurate result among parameters asserted for especially term time (except IVF practices).[11,12] However, for the calculation of this time, there are few studies which have positive or negative contribution on the gender of fetus.

In our study, it was aimed to determine the consistency between weeks of gestation calculated based on LMP and weeks of gestation calculated according to CRL measurement found ultrasonographically at $11^{0/7}$-$13^{6/7}$ weeks in singleton pregnancies, and to compare the results according to genders.

Methods

The study included spontaneous singleton pregnancies retrospectively who had first trimester screening test between 2004 and 2012, without any anatomic anomaly, had gender determination, and with known LMP. Fetal ultrasonography screenings were carried out transabdominally by Voluson 730 Expert (USA) ultrasonography device with 4-7 MHz convex transducer, and gender determination was done by measuring the angle of genital tubercule to the horizontal line passing through lumbosacral skin surface which is complying with the criteria defined in the literature, as genital area is on mid-sagittal plane and fetus is parallel to probe, lower extremities and spine is not on extension but in supine position.[13,14]

The groups were created according to the difference between weeks of gestation calculated based on CRL and weeks of gestation calculated based on LMP, and they were evaluated statistically. The difference groups expressed as [clinical week of gestation calculated based on LMP – ultrasonographic week of gestation based on CRL] were determined as ±1 day, ±2-7 days and ±8 and above. Female and male fetuses were compared in terms of possible difference.

Statistical evaluations were done by using SPSS (SPSS Inc. Released 2008. SPSS Statistics for Windows, Version 17.0; Chicago, IL, USA). Student t-test and chi-square test were used for comparing rate and mean between genders. Statistical significance level was considered as $p<0.05$.

Results

Totally 868 spontaneous pregnant women were included into the study in accordance with the inclusion and exclusion criteria. Mean maternal age of the pregnant women in the study was 30.2±4.0, and mean week of gestation was found as 12.6±0.6. In our study, 55.5% of fetuses (482) were male while 45.5% (386) of them were female. Biometric and demographic information of the fetuses are shown in the **Table 1**. Measurement values were found as low in female fetuses by biometric comparisons of gender groups where no statistical difference was found in terms of maternal age, and this difference was statistically significant for biparietal diameter, head circumference and abdomen circumference.

In terms of the difference between clinical week of gestation based on LMP and ultrasonographic week of gestation based on CRL, the consistency was found as 94.2% with 1 week of deviation (**Table 2**). When the groups were evaluated according to genders, the accuracy rate to determine week of gestation by CRL (with 7 days of deviation) was found as 94% in males while it

Table 1. Biometric measurements (mm) and demographic data of fetuses.

Gender		Maternal age	Week of gest.	CRL	Biparietal diameter*	Head circumference*	Abdominal circumference*	Femur length
Male	Mean	29.87	12.59	62.84	20.97	79.41	63.96	7.47
	Std. dev.	4.01	0.58	7.89	2.69	9.29	8.26	2.03
Female	Mean	30.71	12.56	61.85	20.58	78.01	62.35	7.28
	Std. dev.	4.02	0.57	7.54	2.48	8.29	7.68	1.86
Total	Mean	30.24	12.57	62.39	20.79	78.79	63.24	7.38
	Std. dev.	4.03	0.58	7.75	2.60	8.88	8.04	1.96

*p<0.05

was 94.6% in females (**Table 2**). However, this difference was statistically not significant. The comparison between female and male fetuses in terms of + and – day difference is shown in **Fig. 1**. For zero margin of error, determination of week of gestation by both methods was found as 14% in male fetuses while it was 11% in female fetuses. There was statistically no difference between the groups in terms of negative, positive or zero difference distribution.

The relationship between clinical week of gestation based on LMP and ultrasonographic week of gestation based on CRL is shown in **Fig. 2**. The Pearson correlation coefficient between two variables was found as 0.588. When this coefficient was evaluated separately for male and female fetuses, it was found similarly as 0.590 and 0.589, respectively.

Table 2. Distribution of the difference according to genders between clinical week of gestation based on LMP and ultrasonographic week of gestation based on CRL.

Gender		Number	Percentage
Male	-1 / +1 day	162	33.6
	-7 - 2 / +2 +7 days	291	60.4
	-8 / above +8 days	29	6.0
	Total	482	100.0
Female	-1 + 1 day	126	32.6
	-7 - 2 / +2 +7 days	239	61.9
	-8 / above +8 days	21	5.4
	Total	386	100.0

Discussion

Precise and accurate calculation of pregnancy time is important for health and follow-up of mother and baby. Etiological and epidemiological studies are also important both for health and follow-up of mother and baby, and for infant development such as preterm baby cases.[1] However, the consistency between the pregnancy time based on classical LMP and the pregnancy time based on clinical evaluation where ultrasonography is 47% which is quite low, and it has been reported that using different methods would deliver different results for society health and hospital health evaluations.[1] In terms of gradually worsening general health, hospital admission number and health results, negative impacts of prematurity dating back to 3- and 5-year-old childhood period shown in society-based cohort study emphasize how important is to determine pregnancy time accurately.[2] In an epidemiologic study performed on wide population, it was reported that being preterm or not based on week of gestation used on birth cards and therefore deciding fetal follow-up varies according to calculation method of week of ges-

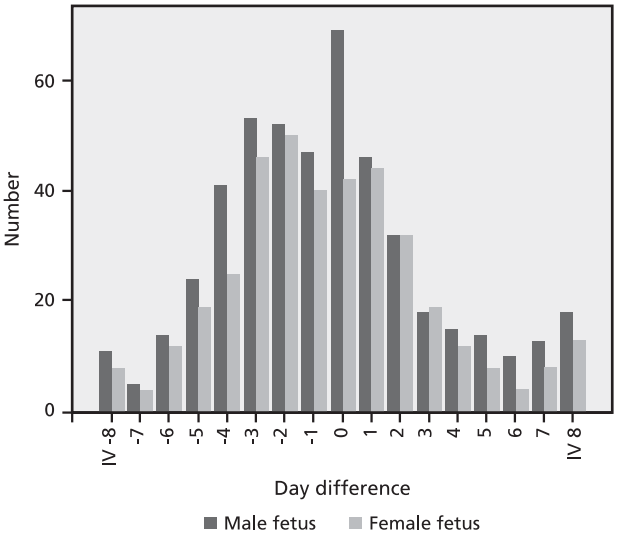

Fig. 1. Comparison between male and female fetuses in terms of + and - day difference.

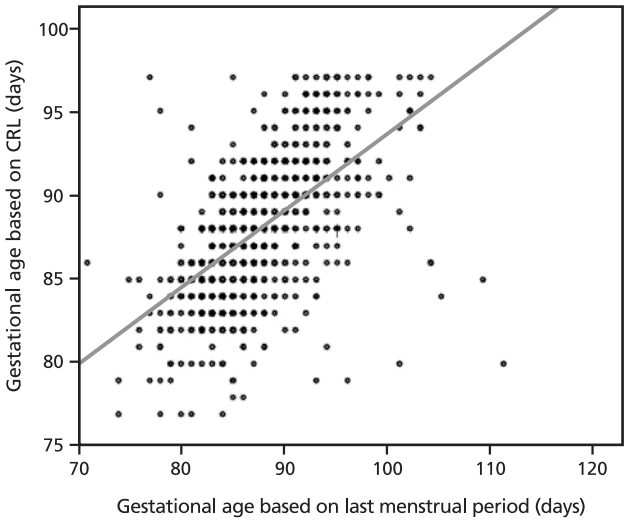

Fig. 2. The relationship between clinical week of gestation based on LMP and ultrasonographic week of gestation based on CRL (the stars represent the weeks of gestation of each fetus).

tation (based on either LMP or ultrasonographic evaluation).[3] Interestingly, the patient group where both evaluation methods are inconsistent with each other at the highest rate comprises of preterm babies. In this study, it has been shown that the inconsistency was affected negatively by various factors such as young maternal age, low education level of mother, late start of pregnancy follow-up and absence of ultrasonography use.[3] Again, in comparison of consistencies in terms of preterm baby between calculation methods either based on LMP in birth certificates or ultrasonographic evaluation, preterm baby rate with LMP was found as 9.9% while it was 7.9% by clinic calculation.[4]

It was shown that ultrasonography use in clinical evaluation for week of gestation provided more accurate results in the follow-up compared to LMP evaluation.[5-8,11,12] In the studies where clinical week of gestation was estimated especially based on ultrasonography, the preterm rate was found as 8.7% for the estimation based on LMP while it was 7.9% for the estimation based on ultrasonography.[6] In this study, it was reported that young maternal age, low education level of mother, and late start of pregnancy follow-up caused negative impact.[6] In the said study, although preterm baby rates were shown higher with LMP, it was reported in another study performed via ultrasonography that preterm baby was 9.1% by ultrasonographic estimation while it was 7.6% with LMP.[7] However, even though it was stated as early period ultrasonography, the time for ultrasonography was 16-18 weeks.[7] Thus, the estimation for week of gestation by ultrasonography at 11-14 weeks of gestation was more consistent with LMP, and this rate was 80.8% with +/-7 days of deviation as confirmed in our study.[8] Also it was shown that young maternal age had a significant role on determining the difference. In another evaluation performed based on LMP, it was reported that there is a risk to get post-term baby rates falsely high.[8]

Although pregnancy time has such a significant role, an evaluation made recently in Netherlands, which has a long-established health system, has showed that those who carried out sonography for the same LMP based on ultrasonographic screening found different pregnancy time in 44% of them.[9] In addition to the factors associated with the applier affecting sonographic evaluation, different calculation algorithms used by sonography devices may provide different results.[10] International Fetal and Newborn Growth Consortium for the 21st Century (INTERGROWTH-21st), which emphasizes the lack of standardization on this issue, suggested using only one of the algorithms for the estimation based on CRL.[15]

In a study where the differences of fetal biometrics such as BPD, HC, AC and FL were evaluated according to genders between 15 and 40 weeks of gestation, BPD, HC and AC in male fetuses were found statistically significant and slightly higher than female fetuses, there was no difference in FL.[16] This condition is also supported by our study, and it is shown that this difference starts as of 11-13 weeks of gestation at least. At this point, in case that these parameters are taken as a basis for the ultrasonographic determination of gestation age, it would be useful to emphasize the significance of using nomogram based on genders.

In addition to the studies in the literature, we analyzed in our study if the consistency between both calculation methods, one based on sonographic evaluation and the other based on last menstrual period, was affected by fetal gender. Consequently, we determined that the consistencies were as high as shown in the literature; however, sonographic calculation based on CRL was not affected by the gender.

Conclusion

First trimester ultrasonographic CRL measurements conform to clinical week of gestation calculated at a high rate on ±7 days of deviation. Genders had no impact on this rate.

Conflicts of Interest: No conflicts declared.

References

1. Alexander GR, Tompkins ME, Petersen DJ, Hulsey TC, Mor J. Discordance between LMP-based and clinically estimated gestational age: implications for research, programs, and policy. Public Health Rep 1995;110:395-402.
2. Boyle EM, Poulsen G, Field DJ, Kurinczuk JJ, Wolke D, Alfirevic Z, et al. Effects of gestational age at birth on health outcomes at 3 and 5 years of age: population based cohort study. BMJ 2012 ;344:e896.
3. Qin C, Hsia J, Berg CJ. Variation between last-menstrual-period and clinical estimates of gestational age in vital records. Am J Epidemiol 2008;167:646-52.
4. Wingate MS, Alexander GR, Buekens P, Vahratian A. Comparison of gestational age classifications: date of last menstrual period vs. clinical estimate. Ann Epidemiol 2007; 17:425-30.

5. Savitz DA, Terry JW Jr, Dole N, Thorp JM Jr, Siega-Riz AM, Herring AH. Comparison of pregnancy dating by last menstrual period, ultrasound scanning, and their combination. Am J Obstet Gynecol 2002;187:1660-6.
6. Dietz PM, England LJ, Callaghan WM, Pearl M, Wier ML, Kharrazi M. A comparison of LMP-based and ultrasound-based estimates of gestational age using linked California livebirth and prenatal screening records. Paediatr Perinat Epidemiol 2007;21:62-71.
7. Yang H, Kramer MS, Platt RW, Blondel B, Bréart G, Morin I, et al. How does early ultrasound scan estimation of gestational age lead to higher rates of preterm birth? Am J Obstet Gynecol 2002;186:433-7.
8. Hoffman CS, Messer LC, Mendola P, Savitz DA, Herring AH, Hartmann KE. Comparison of gestational age at birth based on last menstrual period and ultrasound during the first trimester. Paediatr Perinat Epidemiol 2008 ;22:587-96.
9. Koster MP, Van Leeuwen-Spruijt M, Wortelboer EJ, Stoutenbeek P, Elvers LH, Loeber JG, et al. Lack of standardization in determining gestational age for prenatal screening. Ultrasound Obstet Gynecol 2008;32:607-11.
10. Pereira AP, Dias MA, Bastos MH, da Gama SG, Leal Mdo C. Determining gestational age for public health care users in Brazil: comparison of methods and algorithm creation. BMC Res Notes. 2013;6:60.
11. Taipale P, Hiilesmaa V. Predicting delivery date by ultrasound and last menstrual period in early gestation. Obstet Gynecol 2001;97:189-94.
12. Sladkevicius P, Saltvedt S, Almström H, Kublickas M, Grunewald C, Valentin L. Ultrasound dating at 12-14 weeks of gestation. A prospective cross-validation of established dating formulae in in-vitro fertilized pregnancies. Ultrasound Obstet Gynecol 2005;26:504-11.
13. Efrat Z, Akinfenwa OO, Nicolaides KH. First-trimester determination of fetal gender by ultrasound. Ultrasound Obstet Gynecol 1999;13:305-7.
14. Efrat Z, Perri T, Ramati E, Tugendreich D, Meizner I. Fetal gender assignment by first-trimester ultrasound. Ultrasound Obstet Gynecol 2006;27:619-21.
15. Ioannou C, Sarris I, Hoch L, Salomon L, Papageorghiou A; the International Fetal and Newborn Growth Consortium for the 21st Century (INTERGROWTH-21st). Standardisation of crown-rump length measurement. BJOG 2013;120 Suppl 2:38-41.
16. Schwärzler P, Bland JM, Holden D, Campbell S, Ville Y. Sex-specific antenatal reference growth charts for uncomplicated singleton pregnancies at 15-40 weeks of gestation. Ultrasound Obstet Gynecol 2004;23:23-9.