Comparison of the Mean Uterine Artery Pulsatility Index Global Reference with an Asian Indian Population of Pregnant Women in the Samrakshan Program—Differences and Implications

Rijo Mathew Choorakuttil[1] Praveen K. Nirmalan[2]

[1] AMMA Center for Diagnosis and Preventive Medicine, Kochi, Kerala, India
[2] AMMA Education and Research Foundation, AMMA Healthcare Research Gurukul, Kochi, Kerala, India

Address for correspondence Rijo M Choorakuttil, MD, AMMA Center for Diagnosis and Preventive Medicine Pvt Ltd, Kochi 682036, Kerala, India (e-mail: rijomc@gmail.com).

Indian J Radiol Imaging 2022;32:435–437.

Doppler ultrasound assessments are used more often to screen and prognosticate for adverse maternal and perinatal outcomes.[1–6] Ultrasound examination of the uterine artery (UA) helps to assess uteroplacental circulation from early gestation through the course of pregnancy. The mean UAPI is among the most common UA indices that are currently assessed. The mean UAPI is used to screen and prognosticate for the development of pre-eclampsia (PE), fetal growth restriction (FGR), still birth, placental abruption, and other adverse perinatal outcomes.[1–6] Gómez et al[7] have published global reference ranges for the mean UAPI for 11 to 41 gestational weeks of pregnancy; however, population reference ranges for pregnant Asian Indian women are not available.

Samrakshan is a national program of the Indian Radiological and Imaging Association that aims to improve perinatal outcomes in India.[8] The program utilizes trimester-specific doppler ultrasound assessments to screen, identify, and prognosticate for the development of preterm PE and FGR. The ultrasound examinations are done using a transabdominal approach and standard methods for the assessment of the UAPI, umbilical artery PI, middle cerebral artery PI, and the estimation of the cerebroplacental ratio. The Doppler assessment values are input into globally validated algorithms to identify women at high risk for the development of preterm PE and FGR. We compared the gestational age-specific mean UAPI values of 12,711 pregnant women screened in the Samrakshan program with the published global reference standards[7] to identify differences in the gestation-specific percentile values, and to determine the potential mismatch in the magnitude of mean UAPI >95th percentile if we use the local population data and the global reference.

We observed that the mean UAPI values of the global reference[7] and the Samrakshan based data were nearly similar for the 5th and 50th percentiles across all gestational ages. However, the gestational age-specific global reference range of the mean UAPI 95th percentile was significantly lower than the corresponding Samrakshan-based data across most gestational ages (see ►**Table 1**). This led to a significant difference in the magnitude of pregnant women identified with an abnormal UAPI across most gestational ages (see ►**Table 2**). The difference in percentile values can possibly be attributed to a systematic error in measurement—either observer error or a systematic instrumentation bias. However, the similarities at the 5th and 50th percentile values and the presence of a difference only at the higher percentiles suggest that factors other than observer and instrumentation errors may contribute to this discrepancy. It is possible that true population differences due to structural and functional changes based on ethnicity and genes contribute to the discrepancy in percentile values. The underlying population prevalence of pregnancy induced hypertension, chronic hypertension, and PE and other

published online
August 23, 2022

DOI https://doi.org/10.1055/s-0042-1754346.
ISSN 0971-3026.

Thieme Medical and Scientific Publishers Pvt. Ltd., A-12, 2nd Floor, Sector 2, Noida-201301 UP, India

Table 1 Comparison of the 5th, 50th, and 95th percentile global reference values of the mean uterine artery pulsatility index with the values obtained from 12,711 pregnant women in the Samrakshan India program

Gestational age in weeks	Samrakshan India *n*	5th percentile-global	5th percentile-Samrakshan India	50th percentile-global	50th percentile-Samrakshan India	95th percentile-global	95th percentile-Samrakshan India
11	391	1.18	0.96	1.79	1.66	2.70	2.65
12	1836	1.11	0.92	1.68	1.67	2.53	2.7
13	1879	1.05	0.89	1.58	1.67	2.38	2.7
19	1579	0.78	0.66	1.15	1.05	1.70	1.94
20	979	0.74	0.64	1.10	1.00	1.61	1.8
21	687	0.71	0.61	1.05	0.96	1.54	1.71
22	513	0.69	0.61	1.00	0.92	1.47	1.59
23	308	0.66	0.57	0.96	0.90	1.41	1.59
24	227	0.64	0.59	0.93	0.9	1.35	1.52
30	281	0.54	0.5	0.77	0.77	1.10	1.38
31	307	0.52	0.52	0.75	0.76	1.06	1.40
32	378	0.51	0.51	0.73	0.73	1.04	1.26
33	504	0.50	0.48	0.71	0.73	1.01	1.41
34	640	0.50	0.47	0.70	0.72	0.99	1.27
35	674	0.49	0.47	0.69	0.71	0.97	1.24
36	571	0.48	0.49	0.68	0.72	0.95	1.23
37	366	0.48	0.47	0.67	0.7	0.94	1.18
38	113	0.47	0.47	0.66	0.68	0.92	1.34
39	46	0.47	0.49	0.65	0.67	0.91	1.25
40	20	0.47	0.48	0.67	0.73	0.90	1.26

Table 2 Distribution of abnormal pregnant women based on the >95th percentile value of the mean uterine artery index among the 12,711 participants in the Samrakshan program

Gestational age in weeks	Samrakshan India, *n*	>95th percentile-global, *n* (%)	>95th percentile-Samrakshan India, *n* (%)	N-1 chi-squared test
11	391	16 (4.09)	19 (4.86)	0.61
12	1836	141 (7.68)	90 (4.90)	0.0005
13	1879	229 (12.19)	90 (4.79)	<0.0001
19	1579	133 (8.42)	83 (5.26)	0.0004
20	979	83 (8.48)	45 (4.60)	0.0005
21	687	56 (8.15)	34 (4.95)	<0.001
22	513	40 (7.80)	25 (4.87)	0.05
23	308	14 (4.55)	6 (1.95)	0.07
24	227	19 (8.37)	8 (3.52)	0.03
30	281	32 (11.39)	13 (4.63)	0.003
31	307	53 (17.26)	15 (4.88)	<0.001
32	378	40 (10.58)	18 (4.76)	0.003
33	504	81 (16.07)	24 (4.76)	<0.0001
34	640	97 (15.16)	31 (4.84)	<0.0001
35	674	112 (16.62)	33 (4.90)	<0.0001
36	571	105 (18.39)	28 (4.90)	<0.0001
37	366	54 (14.75)	18 (4.92)	<0.0001
38	113	23 (20.35)	5 (4.42)	0.0003
39	46	8 (17.39)	2 (4.35)	0.05
40	20	6 (30)	2 (10)	0.11

metabolic diseases is higher in Asian Indian populations compared to Caucasian populations. This may possibly contribute to an increased underlying pathologic change in the structure and function of blood vessels in this population and hence abnormal findings on Doppler ultrasound. Additionally, environmental factors including nutrition, and personal risk factors may contribute to the difference in the percentile values. We have not excluded pregnant women with comorbidities, obesity, and advanced age from the data analysis. It is possible that these factors may contribute to the higher magnitude of pregnant women with a mean UAPI >95th percentile.

Clinically, the significant difference in the proportion of women identified with an abnormal UA Doppler PI is problematic as mean UAPI is an integral part of the screening and prognostic assessments. A clinical dilemma to resolve is the balance between the identification of more women at high risk for adverse outcomes if we use the global reference range (false positives) and the possible miss of many women at high risk if we use the values determined from the Samrakshan data (false negatives) to inform the clinical decision-making algorithm based on risk. The consequences of missing assessments for a pregnant woman at high risk for PE and FGR can be devastating for the mother, fetus, and family. Many false positives will stretch the strained healthcare infrastructure. The resolution of the appropriate reference range to use is possible through the development of an appropriate normative reference range for gestation ages 11 to 41 weeks for Asian Indians. The development of the gestation specific normative reference range must be done on pregnant women with normal parameters and must be linked with analysis of the outcomes to be robust. Our preliminary analysis highlights the need for fetal radiologists in India to develop such a reference range for optimal management during pregnancy.

Financial Disclosures
None.

Conflicts of Interest
None.

References

1 Martin AM, Bindra R, Curcio P, Cicero S, Nicolaides KH. Screening for pre-eclampsia and fetal growth restriction by uterine artery Doppler at 11-14 weeks of gestation. Ultrasound Obstet Gynecol 2001;18(06):583–586

2 Gómez O, Martínez JM, Figueras F, et al. Uterine artery Doppler at 11-14 weeks of gestation to screen for hypertensive disorders and associated complications in an unselected population. Ultrasound Obstet Gynecol 2005;26(05):490–494

3 Albaiges G, Missfelder-Lobos H, Lees C, Parra M, Nicolaides KH. One-stage screening for pregnancy complications by color Doppler assessment of the uterine arteries at 23 weeks' gestation. Obstet Gynecol 2000;96(04):559–564

4 Becker R, Vonk R, Vollert W, Entezami M. Doppler sonography of uterine arteries at 20-23 weeks: risk assessment of adverse pregnancy outcome by quantification of impedance and notch. J Perinat Med 2002;30(05):388–394

5 Hernandez-Andrade E, Brodszki J, Lingman G, Gudmundsson S, Molin J, Marsál K. Uterine artery score and perinatal outcome. Ultrasound Obstet Gynecol 2002;19(05):438–442

6 Vergani P, Roncaglia N, Andreotti C, et al. Prognostic value of uterine artery Doppler velocimetry in growth-restricted fetuses delivered near term. Am J Obstet Gynecol 2002;187(04):932–936

7 Gómez O, Figueras F, Fernández S, et al. Reference ranges for uterine artery mean pulsatility index at 11-41 weeks of gestation. Ultrasound Obstet Gynecol 2008;32(02):128–132

8 Choorakuttil RM, Patel H, Bavaharan R, et al. Samrakshan: An Indian Radiological and Imaging Association program to reduce perinatal mortality in India. Indian J Radiol Imaging 2019;29(04): 412–417

