

# HC/AC Ratio as a Predictor of Intrauterine Growth Retardation during Pregnancy: Diagnostic Tool

NAILA ASHFAQ<sup>1\*</sup>, NAUREEN GHANI<sup>2</sup>, RUQIA ZAFAR<sup>3</sup>, WAFI AALAM<sup>1</sup>, SAMEER TOUQIR<sup>1</sup>

<sup>1</sup>Department of Obstetrics & Gynecology, CMH-Kharian

<sup>2</sup>Department of Obstetrics & Gynecology, CMH-Lahore

<sup>3</sup>Department of Obstetrics & Gynecology, THQ, Wazirabad- Pakistan

Correspondence to Dr. Naila Ashfaq, Email: NailaAshfaq@gmail.com Tel:+92-333-4418960

## ABSTRACT

Fetal wellbeing is predicted by his growth assessment during pregnancy.

**Aim:** To evaluate HC/AC ratio as a predictor of intrauterine growth retardation during pregnancy.

**Study design:** Cross sectional study.

**Methodology:** Total of 80 singleton pregnant females with an age ranging from 18-40 years having 20 weeks gestation were enrolled at Combined Military Hospital Kharian. Ultrasound abdomen was done for all enrolled subjects while HC/AC ratio was calculated. All data was noted on Performa. Consent was taken before enrollment. SPSS v.26 analyzed the data. Frequency and percentages were used for quantitative parameters.

**Results:** The mean HC/AC on ultrasound was  $1.46 \pm 0.14$ . There were 35 (43.75%) positive for IUGR while 45 (56.25%) were negative for IUGR. **Conclusion:** It was concluded that HC/AC ratio can serve as a predictor of IUGR during pregnancy with high diagnostic accuracy.

**Keywords:** Abdominal Circumference, Head Circumference and Birth Weight.

## INTRODUCTION

Literature review has revealed that high mortality incidence of intrauterine growth retardation (IUGR) is due to inaccurate and low recognition (<40%) of this health issue globally<sup>1</sup>. Perfect management of any pregnancy includes proper assessment of gestational age and fetal growth by accurate measuring tools in modern era. Ultrasound is a reliable tool for detection of normal fetal growth and IUGR. However, parameters like Biparital diameter, Transcerebellar diameter, Abdominal Circumference and Femur Length provide better prediction of fetal growth.<sup>2,3</sup> External pressure cause deformation of fetal head thus resulting in growth alterations of fetus as reported by literature review however head circumference remains minimally affected<sup>4-6</sup>. Thus HC/AC ratio can serve as a tool for predicting IUGR<sup>7-9</sup>.

The prevalence of IUGR is six times higher in underdeveloped countries like Pakistan, India, Bangladesh especially Asia in comparison to Europe. According to one report, this burden will increase in underdeveloped countries due to poor diagnostic tools and secondly, many infants are born in home with no birth records<sup>10</sup>. However, its incidence is variable among countries, races and rises with decreasing gestational age. According to an estimate, in Asia almost 75% of all IUGR infants were seen followed by African and Latin American<sup>11</sup>.

There are number of reasons for IUGR among infants like extrinsic factors, decreased transfer of oxygen and nutrition to the fetus. As a result, fetus glycogen and lipids stores vanish thus leading to hypoglycemia at birth. Chronic hypoxemia causes secondary polycythemia. Hypothermia, are often results of Infant with IUGR may present with thrombocytopenia, leukopenia, hypocalcemia, and pulmonary hemorrhage on laboratory findings. If the cause of IUGR is intrinsic to the fetus, growth is restricted due to genetic factors or as a sequela of infection<sup>12</sup>.

One previous study reported the sensitivity, specificity, and diagnostic accuracy as 84%, 92% and 90.4% respectively for HC/AC ratio in predicting IUGR<sup>1</sup>. Rationale of this study is to find out the diagnostic accuracy of HC/AC ratio for our population and their sensitivities in detecting IUGR. As there is no study conducted in Pakistan till now and biometric parameters can be different in different populations as it is influenced by racial, genetic and environmental factors.

The objective of the study was to evaluate HC/AC ratio as a predictor of intrauterine growth retardation during pregnancy.

## METHODOLOGY

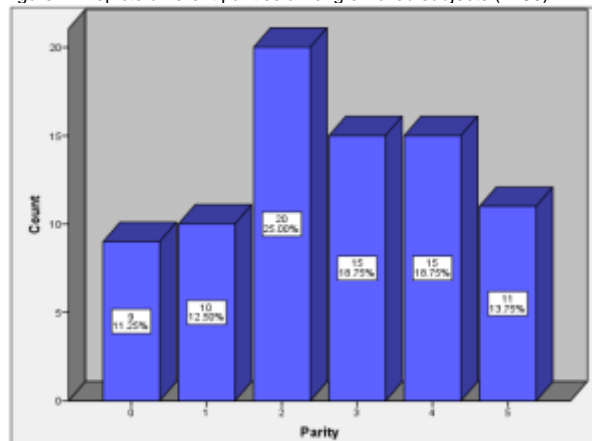
Total of 80 singleton pregnant females with an age ranging from 18-40 years having 20 weeks gestation were enrolled at Combined Military Hospital Kharian. Ultrasound abdomen was done for all enrolled subjects while HC/AC ratio was calculated. All data was noted on Performa. Consent was taken before enrollment. Subjects with history of irregular periods, massively obese were left.

**Statistical analysis:** SPSS v.26.0 analyzed data. Quantitative variables were presented as mean  $\pm$  SD. The qualitative variables like outcome were presented as frequency and percentages. Data was stratified for age and gestational age with P value < 0.05 taken as significant.

## RESULTS

General variables like age, gestational age and BMI were  $28.61 \pm 5.72$  years,  $21.96 \pm 1.50$  weeks and  $25.63 \pm 4.0$  kg/m<sup>2</sup> presented as mean  $\pm$  SD. There were 9 (11.25%) primigravida, 10 (12.50%) primiparous, 20 (25%) had parity 2, 15 (18.75%) had parity 3, had parity 2, 15 (18.75%) had parity 4 and 11 (13.75%) had parity 5 as shown in Fig-1.

Figure-1: Depicts different parities among enrolled subjects (n=80)



The mean HC/AC on ultrasound was  $1.46 \pm 0.14$ . There were 35 (43.75%) positive for IUGR as shown by table-1.

Received on 24-11-2021

Accepted on 14-05-2022

Table 1: Circumferences & IUGR as Mean  $\pm$  SD

| Variables         | Mean $\pm$ SD    | Minimum | Maximum |
|-------------------|------------------|---------|---------|
| HC/AC             | 1.46 $\pm$ 0.14. | 1.25    | 1.70    |
| IUGR              | Positive         | 35      | 43.75%  |
|                   | Negative         | 45      | 56.25%  |
| Birth weight (kg) | 2.55 $\pm$ 0.59  | 1.52    | 3.48    |
| IUGR              | ++++             | 34      | 42.5%   |
|                   | ----             | 46      | 57.5%   |

For prediction of IUGR, HC/AC had 81.25% diagnostic accuracy with sensitivity of 79.41%, as shown in table-2.

Table-2: Accuracy of HC / AC as Predictor of Growth Retardation

| IUGR on HC/AC | IUGR     |          | Total |
|---------------|----------|----------|-------|
|               | Positive | Negative |       |
| ++++          | 27       | 8        | 35    |
| -----         | 7        | 38       | 45    |

In patients aged 19-29years, sensitivity and specificity of HC/AC were 80% and 82.14% respectively as shown in Table-3.

Table-3: Accuracy of HC / AC with Age Stratification

| Age (yrs) | HC/AC    | IUGR     |          | Total |
|-----------|----------|----------|----------|-------|
|           |          | Positive | Negative |       |
| 19-29     | Positive | 16       | 5        | 21    |
|           | Negative | 4        | 23       | 27    |
|           | Total    | 20       | 28       | 48    |
| 30-40     | Positive | 11       | 3        | 14    |
|           | Negative | 3        | 15       | 18    |
|           | Total    | 14       | 18       | 32    |

In patients presented at 20-22weeks, sensitivity, specificity and diagnostic accuracy of HC/AC were 87.5%, 90.48% and 89.19%, respectively as shown in Table 4.

Table-4: Accuracy of HC / AC with Gestational Age Stratification

| GA (weeks) | HC/AC    | IUGR     |          | Total |
|------------|----------|----------|----------|-------|
|            |          | Positive | Negative |       |
| 20-22      | Positive | 14       | 2        | 16    |
|            | Negative | 2        | 19       | 21    |
|            | Total    | 16       | 21       | 37    |
| 23-24      | Positive | 13       | 6        | 19    |
|            | Negative | 5        | 19       | 24    |
|            | Total    | 18       | 25       | 43    |

## DISCUSSION

In present study, mean HC/AC on ultrasound was 1.46 $\pm$ 0.14. There were 35 (43.75%) positive for IUGR. For prediction of IUGR, HC/AC had diagnostic accuracy of 81.25%. Similarly, other studies that showed HC/AC ratio has sensitivity, specificity, PPV, NPV and accuracy of 61.11%, 93.9%, 68.75%, 91.66% and 88%, respectively<sup>13</sup>. These results various other studies showed high specificity (90% and 94%) of head circumference as IUGR predictor respectively<sup>14,15</sup>.

In our study, the mean age of patients was 28.61 $\pm$ 5.72years. Results showed that subjects with age 19-29 years had sensitivity (80%), specificity (82.14%) and diagnostic accuracy (81.25%) of HC/AC respectively. Similar, results were shown in previous study that showed high diagnostic accuracy of head circumference for fetal growth<sup>16</sup>.

In our study, the mean gestational age of patients was 21.96 $\pm$ 1.50 weeks. In patients presented in 23-24 weeks, sensitivity, specificity, PPV, NPV and diagnostic accuracy of HC/AC were 72.22%, 76%, 68.42%, 79.17% and 74.42%, respectively. Similarly, one previous study showed high diagnostic accuracy of head circumference for IUGR when data was stratified for gestational age<sup>17</sup>.

In our study, there were 9(11.25%) primigravida, 10 (12.50%) primiparous, 20(25%) had parity 2, 15(18.75%) had parity 3, had parity 2, 15(18.75%) had parity 4 and 11(13.75%) had parity 5. In multiparous patients, sensitivity, specificity and diagnostic accuracy of HC/AC were 80.65%, 80% and 80.33%,

respectively. Head circumference showed high sensitivity when used for assessing IUGR on the basis of parity in many previous studies thus our work was in line with such studies<sup>18,19</sup>.

**Limitations:** Study lacked genetic workup and was a single centre study with small sample size. More similar studies with larger sample size and multi-centre studies are thus recommended.

## CONCLUSION

It was concluded that HC/AC ratio can serve as a predictor of IUGR during pregnancy with high diagnostic accuracy.

**Conflict of Interest:** None to declare

**Financial Disclosure:** None

**Authors' Contribution:** **NA&NG:** Conceptualized the study, analyzed the data, and formulated the initial draft, **RZ&WA:** Contributed to the proof reading, **ST:** Collected data

## REFERENCES

- Bhimarao RMN, Bhat V, Gowda PV. Efficacy of transcerebellar diameter/abdominal circumference versus head circumference/abdominal circumference in predicting asymmetric intrauterine growth retardation. *Journal of clinical and diagnostic research: JCDR* 2015;9(10):TC01.
- Gull N, Sarfaraz T, Iftikhar T, Sultana N. Trans cerebellar diameter; abdominal circumference is a reliable parameter for assessment of normal fetal growth. *J SOGP* 2015;5(4):208-11.
- Saleem T, Sajjad N, Fatima S, Habib N, Ali SR, Qadir M. Intrauterine growth retardation-small events, big consequences. *Italian journal of pediatrics* 2011;37(1):41.
- Khan N. Role of Transverse Cerebellar Diameter in Diagnosis of Asymmetrical Fetal Growth Restriction. *Journal of Rawalpindi Medical College* 2013;17(2):231-3.
- Gupta AD, Banerjee A, Rammurthy N, Revati P, Jose J, Karak P, et al. Gestational age estimation using transcerebellar diameter with grading of fetal cerebellar growth. *National Journal of Clinical Anatomy* 2012;1(3):115.
- Afshan A, Nadeem S, Shamim Asim S. Fetal transverse cerebellar diameter measurement; a useful predictor of gestational age in growth restricted fetuses. *Professional Medical Journal* 2014;21(5).
- Sharma C, Bhardwaj A, Sharma S, Kharkwal S. Foetal transcerebellar diameter measurement for prediction of gestational age: A more dependable diameter even in IUGR. *IJGP* 2014;13-8.
- Bansal M, Bansal A, Jain S, Khare S. A study of Correlation of Transverse Cerebellar Diameter with Gestational Age in the Normal & Growth Restricted Fetuses in Western Uttar Pradesh. *Peop J Sci Res* 2014;7(2).
- Sharma G, Ghode R. Fetal transcerebellar diameter and transcerebellar diameter-abdominal circumference ratio as a menstrual age independent parameter for gestational age estimation with grading of cerebellar. *International Journal of Reproduction, Contraception, Obstetrics and Gynecology* 2017;4(6):2036-40.
- Lawn JE, Cousens S, Zupan J, Team LNSS. 4 million neonatal deaths: when? Where? Why? *The lancet* 2005;365(9462):891-900.
- Luoto R, Kinnunen TI, Aittasalo M, Kolu P, Raitanen J, Ojala K, et al. Primary prevention of gestational diabetes mellitus and large-for-gestational-age newborns by lifestyle counseling: a cluster-randomized controlled trial. *PLoS medicine* 2011;8(5):e1001036.
- Batalle D, Eixarch E, Figueras F, Muñoz-Moreno E, Bargallo N, Illa M, et al. Altered small-world topology of structural brain networks in infants with intrauterine growth restriction and its association with later neurodevelopmental outcome. *Neuroimage* 2012;60(2):1352-66.
- Geva R, Eshel R, Leitner Y, Valevski AF, Harel S. Neuropsychological outcome of children with intrauterine growth restriction: a 9-year prospective study. *Pediatrics* 2006;118(1):91-100.
- Zaren B, Lindmark G, Gebre-Medhin M. Maternal smoking and body composition of the newborn. *Acta Paediatrica* 1996;85(2):213-9.
- Cohn HE, Sacks EJ, Heymann MA, Rudolph AM. Cardiovascular responses to hypoxemia and acidemia in fetal lambs. *American Journal of Obstetrics & Gynecology* 1974;120(6):817-24.
- Mari G, Hanif F, Kruger M, Cosmi E, Santolaya-Forgas J, Treadwell M. Middle cerebral artery peak systolic velocity: a new Doppler parameter in the assessment of growth-restricted fetuses. *Ultrasound in Obstetrics and Gynecology: The Official Journal of the International Society of Ultrasound in Obstetrics and Gynecology* 2007;29(3):310-6.
- Quinton A, Cook C, Peek M. The prediction of the small for gestational age fetus with the head circumference to abdominal circumference (HC/AC) ratio: a new look at an old measurement. *Sonography* 2015;2(2):27-31.
- Hashimoto K, Shimizu T, Shimoya K, Kanzaki T, Clapp JF, Murata Y. Fetal cerebellum: US appearance with advancing gestational age. *Radiology* 2001;221(1):70-4.
- Goel P, Singla M, Ghai R, Jain S, Budhiraja V, Babu CR. Transverse cerebellar diameter-A marker for estimation of gestational age. *J Anat Soc India* 2010;59(2):158-61.