Original Article

Diagnostic Accuracy of Fetal Abdominal Circumference on Ultrasound in the Detection of Macrosomic Infants

Farah Naz[1], Abid Ali Sahito[2], Ghazala Shahzad[3], Asma Jatoi[4], Sakeena Ahmed Memon[5], Fahmida Parveen[6]

[1] Senior Registrar Radiology, Isra University Hospital Hyderabad
[2,3] Assistant Professor, Radiology department of LUMHS Jamshoro
[4]Senior Registrar, Radiology department of LUMHS Jamshoro
[5]Registrar, Dept. of Obs & Gynae, LUMHS Jamshoro
[6]Assistant Professor, Dept of Obs & Gynae, LUMHS, Jamshoro

Correspondence: *Dr. Farah Naz, Senior Registrar Radiology,*
Isra University Hospital Hyderabad
Email: farahmugheri@gmail.com

Abstract

Objective: To determine the diagnostic accuracy of fetal abdominal circumference on ultrasonography in the detection of macrosomic infants, taking birth weight as gold standard.

Methodology: This descriptive, cross-sectional study was done at department of Radiology Shaheed Zulifiqar Ali Bhutto Medical University Islamabad from May 2016 to October 2016. A total of 226 patients with females with singleton pregnancy with suspected macrosomic infants and age 18-40 years were included. All the patients underwent ultrasonography and presence or absence of macrosomia was noted as per fetal abdominal circumference. Fetal abdominal circumference ≥35 cm was considered as macrosomic. Ultrasonography findings were compared with birth weight in each patient. All the data was collected via study proforma.

Results: Mean age of study subjects was 31.20±5.41 years and mean gestational age 38.06±1.14 weeks. Out of all 144 (63.72%) fetus were diagnosed as macrosomic and as per birth weight observations 138(61.06%) cases diagnosed as macrosomic. However ultrasound sensitivity and specificity were found to be 94.20%, 84.00% and overall diagnostic accuracy was observed 90.27% in the detection of macrosomic infants, taking birth weight as gold standard.

Conclusion: Fetal abdominal circumference on ultrasonography found to be a valuable and noninvasive diagnostic technique for macrosomic infants with sensitivity 94.2% and septicity 84%. Ultrasonography is a highly sensitive and reliable, simple, economical and readily available modality.

Keywords: Fetal abdominal circumference, ultrasonography, sensitivity

Cite this article as: *Abid F N, Sahito A, Shahzad G, Jatoi A, Memon SA, Parveen F. Diagnostic Accuracy of Fetal Abdominal Circumference on Ultrasound in the Detection of Macrosomic Infants.* J Soc Obstet Gynaecol Pak.*2021; 11(1):34-37*

Introduction

Macrosomia is characterised as a birth weight of more than 4 Kg regardless of gestational age or >90th percentiles for gestational age upon adjusting for ethnicity and neonatal sex.[1] Macrosomia influences 3 – 15 percent of all pregnancies worldwide.[2] According to literature, various maternal and perinatal complications are linked to macrosomia and the existence of the large foetus, as described as large for gestational age (LGA) or by a weight cut-off value.[3] Macrosomia has also been linked to shoulder dystocia, skeletal injuries, injury to brachial plexus, meconium aspiration, hypoglycaemia, prenatal asphyxia, and foetal death.[4] Prolonged labour, caesarean delivery, augmentation of labour using oxytocin, postpartum haemorrhage, infection, perineal tears of 3rd & 4th degree, thromboembolic incidents, and anaesthetic events are all maternal complications associated with macrosomia.[3,4] In adulthood, macrosomic babies are more likely to develop type 2 diabetes, obesity, and hypertension. Besides that, shoulder dystocia, intrapartum asphyxia, bone injuries and injury to brachial plexus are possible complications of vaginal childbirth, whereas maternal risks involve injuries to the pelvic floor and birth canal, postpartum haemorrhage

Authorship Contribution: [1,2]Wrtite the first daft of manuscript and interpretation of data, [3,4]drafting and revision of manuscript and data analysis

Funding Source: none
Conflict of Interest: none

Received: Dec 04, 2020
Accepted: April 08, 2021

and increased incidence of caesarean and operative vaginal deliveries.[5] Not just in labour management and delivery management, but also in the administration of growth monitoring and increased risk pregnancies, foetal weight evaluation is an essential and universal aspect of antenatal care.[6] The precision of ultrasound-based fetal weight estimates has increased over the last 10 years, but there is still a poor consistency.[7] Prenatal sonography tends to be more suitable than clinical approaches for conducting weight assessments before birth because ultrasound enables reliable and precise estimation of fetal body circumference and bone length.[8] . For individuals suspected of macrosomic foetus, accurate prenatal measurement of foetal weight in labour and late pregnancy is highly valuable in the administration of pregnancy and childbirth, allowing obstetricians to take decisions regarding instrumental vaginal birth, evaluation of labour following elective caesarean delivery, and caesarean section. So, keeping in mind all the above facts, this study has been conducted to determine the diagnostic accuracy of ultrasonography in the detection of macrosomic infants, taking birth weight as gold standard.

Methodology

This descriptive cross-sectional study was conducted at department of Radiology Shaheed Zulifiqar Ali Bhutto Medical University Islamabad. Study duration was six months from May 2016 to October 2016. All pregnant females age between 18 to 40 years, gestational age 37-41 years having singleton pregnancy and suspected for macrosomic infants were included. Women presented with Polyhydramnios, intrauterine fetal death, breech presentation, multiple pregnancy and those who were not willing to participate in the study were excluded. Study was conducted after taking ethical approval. Informed consent was taken from all the study subjects. All the women underwent ultrasonography for fetal wellbeing by 3.5 MHz machine. All the ultrasounds were conducted by senior radiologists having (at least of 3 years post-fellowship experience). Fetal abdominal circumference ≥35 cm was considered as macrosomic and birth weights above 4000 g and above was considered as macrosomia after birth. Each ultrasonographic finding was compared with birth weight (taking as gold standard). All this data was recorded via study proforma. Data analysis was done by using SPSS version 20.

Results

In this study mean age of study participants was 31.20±5.41 years, Majority of the patients137 (60.62%) were between age group of 31 to 40 years. Average gestational age was 38.06±1.14 weeks and mean parity was 03.34±01.22. Table I

As per ultrasound findings 144 (63.72%) fetus were macrosomic and according to birth weight 138(61.06%) cases diagnosed observed as macrosomic. Table.2

Overall sensitivity, positive predictive value, specificity, negative predictive value and diagnostic accuracy of fetal abdominal circumference on ultrasonography in the detection of macrosomic infants, taking birth weight as gold standard were found to be 94.20%, 90.28%, 84.00%, 90.24% and 90.27% respectively. Table II

Table I: Descriptive statistics of the patients n=226

Variables		Statistics
Age groups	18-30	89(39.38%)
	31-40	137(60.62%)
	Mean ± SD	31.20 ± 5.41 years
Gestational age	37-39 weeks	142 (62.83%)
	>39 weeks	84(37.17%)
	Mean ± SD	38.06 ± 1.14 weeks
Parity	1-2	103(45.58%)
	3-4	123(54.42%)
	Mean ± SD	03.34±01.22

Table II: Diagnostic accuracy of fetal abdominal circumference on ultrasonography in the detection of macrosomic infants, taking birth weight as gold standard

	Positive result on birth weight	Negative result on birth weight	Total	P-value
Positive on USG	130 (TP)*	14 (FP)***	144	0.545
Negative on USG	08 (FN)**	74 (TN)****	82	
Total	138	88		

*-TP=True positive **-FP=False positive ***-FN=False negative ****-TN=True negative
Sensitivity: 94.20%
Specificity: 84.09%
Positive Predictive Value (PPV): 90.28%
Negative Predictive Value (NPV):90.24%
Diagnostic Accuracy: 90.27%

Discussion

Prenatal care must include the detection of premature foetal development, and inability to do so may lead to higher perinatal mortality and morbidity, and also impact the neonate's long-term wellbeing.[9] To avoid adverse perinatal outcomes, accurate screening approaches are needed to detect foetuses with LGA and foetal growth restriction (FGR).[9] However in this study fetal abdominal circumference (AC) on ultrasonography showed sensitivity and specificity as 94.20% and 84.00% in the detection of macrosomic infants, taking birth weight as gold standard. Similarly in the study of Chaabane K et al[10] reported that the abdominal circumference (AC) ≥350 mm on ultrasound showed in the fetal macrosomia prediction, revealed a 78.7% sensitivity, 76.8% specificity, 77% accuracy, 92.6% positive predictive value, and 49.2% negative predictive value. On the other hand in a published abstract of 18th world congress in Fetal Medicine observed that the abdominal circumference ≥350 mm was shown to have 78.7% sensitivity, 76.8% specificity, 77% precision, 92.6% positive predictive value, and 49.2 % negative predictive value.[11] On other hand Youssef AE et al[12] reported 35.5 cm AC cutoff value, 87.7% PPV for macrosomia prediction and 96.4% sensitivity with overall 96.83% of accuracy.

In this study maternal mean age was of 31.20±5.41 years and mean gestational age 38.06±1.14 weeks. On other hand Chaabane K et al[10] reported that the maternal median age was 30.6 years among AC ≥350mm group and 30.2 years among AC ≥350mm group. Similarly Li Y et al[13] reported that the maternal age was 29.22 ± 4.32 in macrosomic fetal group and further they sated that the elevated maternal age can be a risk factor for macrosomia.[13] Prenatal sonography tends to be more suitable than clinical approaches for conducting weight assessments before birth because ultrasound enables reliable and precise assessment of fetal body circumference and bone length. Though, since the fetus has an irregular 3-D body with varying tissue composition and density, it continues to be a concern. It's important for sonographers to remember that fetal AC has the highest influence on weight assessment. Several studies have been done to see how effective the AC is at detecting fetal macrosomia.[14] Kehl S al[15] devised a method for estimating fetal weight with 636 cm of AC. Besides that, serial biometric assessments can be utilized to produce an independent antenatal growth graph to improve the precision of the fetal measured weight. Repeated measurements of foetal AC with sensitivity of 84 % and specificity of 100% predicted a birth weight > 90th percentile.[8] Sonographic diagnosis is a specific and sensitive technique for the assessment of the fetal weight and consequently macrosomia. Abdominal circumference is vital parameter for Sonography for the prediction of macrosomic fetus and the big sized babies.[16]

Conclusion

Fetal abdominal circumference on ultrasonography found to be a valuable and noninvasive diagnostic technique for macrosomic infants with sensitivity 94.2% and septicity 84%. Ultrasonography is a highly sensitive and reliable modality for diagnosing macrosomic infants, and has not only dramatically improved our ability of diagnosing macrosomic infants but also be a simple, economical and readily available modality. However it is recommended that the pre-delivery ultrasonographic estimation of fetal weight can be opted routinely in every term pregnant female for taking proper management decision pre-operatively. Moreover, it can also help the clinicians for taking proper management plans for these particular infants in order to reduce the perinatal morbidity and mortality.

Disclosure: This paper retracted from the FCPS dissertation. The Principal author was PG trainee in dept of Radiology Pakistan institute of medical Sciences, Islamabad.

References

1. Bedu-Addo K, Ephraim RK, Tanoe-Blay C, Ahenkorah-Fondjo L, Osei-Darkwah K, Ephraim M, et al. Prevalence and associated factors of fetal macrosomia in a rural community in Ghana. Cogent Medicine. 2020;1;7(1):1746602.
2. Biratu AK, Wakgari N, Jikamo B. Magnitude of fetal macrosomia and its associated factors at public health institutions of Hawassa city, southern Ethiopia. BMC research notes. 2018;11(1):1-6..
3. Beta J, Khan N, Fiolna M, Khalil A, Ramadan G, Akolekar R. Maternal and neonatal complications of fetal macrosomia: cohort study. Ultrasound in Obstetrics & Gynecology. 2019 Sep;54(3):319-25.
4. Mohammadbeigi A, Farhadifar F, Zadeh NS, Mohammadsalehi N, Rezaiee M, Aghaei M. Fetal macrosomia: risk factors, maternal, and perinatal outcome. Annals of medical and health sciences research. 2013;3(4):546-50.
5. Njoku C, Emechebe C, Odusolu P, Abeshi S, Chukwu C, Ekabua J. Determination of accuracy of fetal weight using ultrasound and clinical fetal weight estimations in Calabar South, South Nigeria. Int Scholarly Res Notices. 2014;2014:970-73
6. Ugwu EO, Udealor PC, Dim CC. Accuracy of clinical and ultrasound estimation of fetal weight in predicting actual birth weight in Enugu, Southeastern Nigeria. Nigerian J Clin Practice. 2014;17(3):270–75

7. Milner J, Arezina J. The accuracy of ultrasound estimation of fetal weight in comparison to birth weight: A systematic review. Ultrasound. 2018 Feb;26(1):32-41.
8. Bamberg C, Hinkson L, Henrich W. Prenatal detection and consequences of fetal macrosomia. Fetal diagnosis and therapy. 2013;33(3):143-8.
9. Haragan AF, Hulsey TC, Hawk AF, et al. Diagnostic accuracy of fundal height and handheld ultrasound-measured abdominal circumference to screen for fetal growth abnormalities. Am J Obstet Gynecol 2015;212:820.e1-8.
10. Chaabane K, Trigui K, Louati D, Kebaili S, Gassara H, Dammak A, Amouri H, Guermazi M. Antenatal macrosomia prediction using sonographic fetal abdominal circumference in South Tunisia. The Pan African Medical Journal. 2013;14.
11. Karoui A, Charfeddine M, Abid C Abdelmoula B, Alioua I, Abouda H, Channoufi B. The prediction of fetal macrosomia by measuring the abdominal circumference. 18th World Congress in Fetal Medicine.https://fetalmedicine.org/abstracts/2019/var/pdf/abstracts/2019/03670.pdf
12. Youssef AE, Amin AF, Khalaf M, Khalaf MS, Ali MK, Abbas AM. Fetal biacromial diameter as a new ultrasound measure for prediction of macrosomia in term pregnancy: a prospective observational study. The Journal of Maternal-Fetal & Neonatal Medicine. 2019 Aug 18;32(16):2674-9.
13. Li Y, Liu QF, Zhang D, Shen Y, Ye K, Lai HL, Wang HQ, Hu CL, Zhao QH, Li L. Weight gain in pregnancy, maternal age and gestational age in relation to fetal macrosomia. Clinical Nutrition Research. 2015 Apr 1;4(2):104-9.
14. Loetworawanit R, Chittacharoen A, SututvoravutS: Intrapartum fetal abdominal circumferenceby ultrasonography for predictingfetal macrosomia. J Med Assoc Thai. 2006; 89(suppl 4):S60–S64.
15. Kehl S, Korber C, Hart N, Goecke TW, SchildRL, Siemer J: New sonographic method forfetuses with a large abdominal circumferenceimproves fetal weight estimation. UltraschallMed 2012; 33: 265–269.
16. Abdella RM, Ahmed SA, Moustafa MI. Sonographic evaluation of fetal abdominal circumference and cerebroplacental Doppler indices for the prediction of fetal macrosomia in full term pregnant women. Cohort study. Middle East Fertility Society Journal. 2014 Mar 1;19(1):69-74.