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Sensitivity and Specificity of Abdominal Circumference as Single Marker in Predicting Macrosomia at Haji Adam Malik Hospital Medan 2017-2021

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Abstract

BACKGROUND: Macrosomia incidence rate seems continue to increase, especially in Indonesia with a fairly high incidence rate, macrosomia is associated with adverse complications; therefore, early detection is recommended so that optimal management can be determined. At present, abdominal circumferences are considered as most predictive of fetal weight and expected to be used for macrosomia screening.

AIM: This research purpose was to determine sensitivity and specificity of Abdominal Circumference (AC) as a single marker in predicting macrosomia at Haji Adam Malik Hospital Medan 2017–2021.

METHODS: This research is an analytical study with diagnostic test of secondary data from medical records on February 7, 2022–April 30, 2022. Research sample was pregnant women with macrosomia or non-macrosomia fetuses who gave birth in obstetrics department at H. Adam Malik Hospital Medan and met inclusion criteria. Calculation sensitivity and specificity of AC values was carried out to diagnose macrosomia. An analysis of area under the curve (AUC) curve will be carried out to determine *cut off* AC value in diagnosing macrosomia.

RESULTS: Based on ROC curve, AUC is 0.923 which means AC can diagnose macrosomia by 92.3%. After calculation of sensitivity and specificity values, it was found that AC value with *cut off* 34.56 had sensitivity 83% and specificity 89% in predicting macrosomia.

CONCLUSION: AC measurement is considered most effective method for predict baby's birth weight with fairly good level of sensitivity (83%) and specificity (89%).

Introduction

Macrosomia is a term used to describe an estimated fetal weight (EFW) or birth weight >4000 g. This term is often used as a synonym for large fetus for pregnancy (birth weight >90th percentile), and almost 10% of all pregnancies with macrosomia [1]. Indonesia as a developing country has high macrosomia births percentage. The percentage of birth weight babies >4000 g in Indonesia has reached 6.4%, this figure is in accordance with macrosomia incidence in worldwide which generally ranges from 6 to 10% of total births [2].

Macrosomic infants are 4.7 times more likely to experience hypoglycemia and cause maternal complications such as cesarean delivery 4.1 times more often compared to non-macrosomia infants [3], [4], [5]. Macrosomia increases risk of postpartum hemorrhage 1.53 greater than mothers who give birth to normal birth weight babies. In addition, mothers who gave birth to macrosomia babies had 3 times greater risk of perineal rupture than mothers who gave birth to babies weighing <4000 g [5].

Prediction of fetal macrosomia can be made using clinical evaluation and ultrasound. Clinical evaluation is carried out by determining the height of the uterine fundus, then the calculation is carried out using the Johnson Toshach formula or the Risanto formula. However, the prediction of macrosomia is influenced by obesity and composition of subcutaneous fat therefore has limited their use [6]. Added to this the more that occurs at birth, making it difficult to perform intrapartum ultrasonography. The connected vertex can ensure the accuracy of biparietal diameter measurement and affect the accuracy of intrapartum fetal weight evaluation.

The image gradient-based method showed stable performance for high-contrast HC and FL environments, which AC measurements were considered more challenging because fetal abdomen had low environmental contrast, non-uniform contrast, and irregular shape on ultrasound images. Therefore, among biometric measurements, AC was the most

predictive of fetal weight, whereas variations in AC measurements led to significant differences in EFW [7]. Abdella *et al*. in their study also found that AC can be used as a single marker in diagnosing macrosomia [8].

Until now data describing correlation of Abdominal Circumference (AC) as a single marker in predicting macrosomia in the literature still limited. Research on AC as a single marker in predicting macrosomia has also never been done in Indonesia. Therefore, researchers are supposed to determine role of AC value as a single predictor marker in predicting macrosomia.

Methods

This research is an analytic study conducted at H. Adam Malik General Hospital Medan during period February 7, 2022–April 30, 2022. Sample data taken from secondary data by medical records. The research sample was pregnant women with macrosomia or non-macrosomia fetuses who gave birth in obstetrics department and met inclusion criteria, namely, mothers who gave birth at Haji Adam Malik Hospital Medan, gestational age >37 weeks, complete medical records; in which complete data of mother's name (patient), maternal age, gestational age, parity, baby's birth weight, gender and previous partus history, and ultrasnography examination records. Based on calculations, minimum sample size for this research was 577 people. All data are tabulated and statistically analyzed.

Statistical analysis

Data were obtained from patients medical records who met inclusion criteria and register number, name, age, parity, and AC were recorded. Data were collected, input, and tabulated using statistical software. The research results are presented in frequency distribution table. Frequency distribution of research sample characteristics was assess with univariate statistical analysis. Then, AC sensitivity and specificity values will be calculated for diagnosing macrosomia using 2 × 2 table. Analysis of area under curve (AUC) curve will be carried out to determine *cutoff* AC value in diagnosing macrosomia.

Results

This research was conducted on medical records of pregnant women with gestational age >37 weeks who gave birth at H. Adam Malik General Hospital Medan in 2017–2021, and data were obtained as many as 895 cases. Of 895 cases, screening was carried out according to inclusion criteria. After screening, 18 cases of macrosomia and 559 cases of non-macrosomia were found (Table 1).

Table 1: Research subjects characteristics based on maternal age, gravida, gestational age, baby gender, and glucose ad random levels

Characteristics	Research subjects	
	Macrosomia	Non-macrosomia
Age (years old)		
<20	-	16
20–35	16	423
35–50	2	120
Parity		
Primiparous	3	145
Secundiparous	5	140
Multiparous	10	274
Gestational age (weeks)		
37	2	315
38	8	177
39	4	52
40	4	15
Gender		
Male	9	267
Female	9	292
Glucose ad random		
<200 mg/dL	15	556
>200 mg/dL	3	3
History of macrosomia		
Yes	3	1
No	15	558

Diagnostic tests were carried out to determine strength of AC diagnostic value as a screening tool for macrosomia, with analysis of ROC curve, sensitivity, and specificity values (Figures 1 and 2).

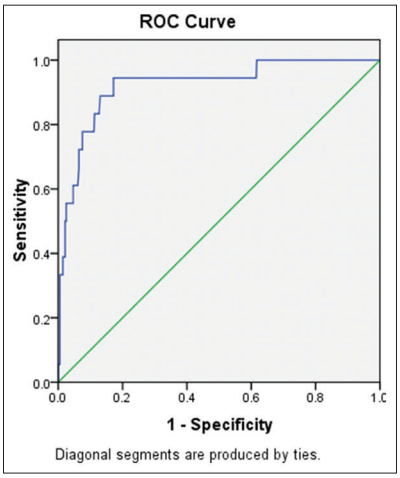

Figure 1: Area under curve of abdominal circumference in detecting macrosomia

Based on ROC curve, AUC is 0.923 which means AC can diagnose macrosomia by 92.3%. After calculation

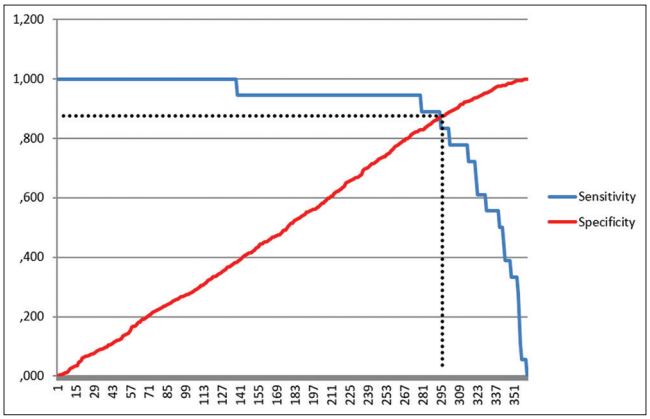

Figure 2: Optimal cutoff sensitivity and specificity of abdominal circumference in detecting macrosomia

of sensitivity and specificity values, it was found that AC value with cutoff 34.56 had sensitivity 83% and specificity 89%. This means that AC value 34.56 cm can detected 83% of total macrosomia cases and precisely diagnosis 89% of total patients without macrosomia.

Discussions

Research conducted by Said and Manji found a strong relationship between fetus macrosomia and maternal age over 30 years. In his research, 55.3% of macrosomic infants were born to mothers aged 30–39 years. Maternal age under 30 years or more than 40 years is not significantly associated with macrosomia incidence [3]. Meanwhile, from this research results, it was found that pregnant women characteristics with macrosomia were more commonly found at age of 20–35 years.

Said and Manji in their research found that 89.3% of mothers who gave birth to macrosomic babies were multiparous mothers. Melani in her research also found that multiparous mothers were 15 times more likely to have newborns macrosomia compared to primiparous mothers [3]. In accordance with this research results, it was found that macrosomia incidence was more common in multiparous mothers. Abdella *et al*. in their study found that gestation 37 weeks and >37 weeks were 6 times more likely to have a macrosomic baby [8]. In this research, it was found that macrosomia incidence was more common at gestation 38 weeks.

Said and Manji in their research found that mothers with diabetes mellitus were 10 times more likely to give birth to macrosomic babies compared to mothers without diabetes mellitus [3]. Women with gestational diabetes were 1.2 times more likely to have a macrosomic baby [9]. In contrast to this research results, which found that macrosomia incidence was more common in women with blood sugar levels <200 g/dL. A blood sugar level <200 g/dL without use of diabetes medications is defined as a non-diabetic mother.

History of giving birth to macrosomic baby increased the risk of having macrosomic baby 6672 times compared to mothers who didn't have a history [5]. In this research, out of 18 macrosomia events, only three mothers had a history of macrosomia, this indicates that only 16.67% of mothers in macrosomia group had a history of macrosomia.

Accurate weight estimation in macrosomic fetuses is very important in labor management. Birth canal trauma, perinatal asphyxia, and increased maternal morbidity occur in pregnant women with macrosomia who deliver vaginally. Discomfort that occurs at delivery complicated perform intrapartum ultrasonography. An engaged vertex can impede accuracy of biparietal diameter measurement and affect accuracy of intrapartum fetal weight evaluation.

Campbell and Wilkin in 1975 first emphasized USG measurement importance of fetal AC [5]. Smith *et al*. compared two models for measuring birth weight estimation using three biometric parameters (AC, BPD, and FL) and AC as single parameter to predict fetal macrosomia. It was found that measurement of three parameters is less accurate in determining EFW compared to AC measurement as a single parameter [11].

Systemic review found that singleton AC measurements were as accurate as EFW tests in predicting macrosomia in general population when USG examinations were performed several days before delivery at term [12].

Blue *et al*. in their study compared AC and EFW to identify babies' birth weights to showed significant results. AC measurement as a method for detecting infant weight is considered simpler and requires a shorter time with same level effectiveness as EFW measurement. However, Smith *et al*. do not recommend placing AC measurements as a substitute for detailed anatomical assessment [13]. Weissmann and colleagues suggested AC measurement as a single predictor that was better at predicting birth weight than EFW using a combination of BPD, AC, and FL [14].

AC cutoff value >350 mm in predicting macrosomia had sensitivity, specificity, accuracy, positive predictive value, and negative predictive value of: 78.7%, 76.8%, 77%, 92.6%, and 49.2%. In macrosomia group with obese mothers, it was more common significantly with AC > 350 mm [5], [15].

Ratchanikon conducted a study that followed 361 pregnant women with single babies who entered delivery room. This study states that AC cutoff value is > 35 cm to indicate high sensitivity and specificity in predicting macrosomia. The sensitivity of AC 35 cm to correctly identify fetus macrosomia is 87.5%, specificity is 84.74%, positive predictive value is 41.67%, negative predictive value is 98.18%, and accuracy is 85.04% with positive likelihood ratio 5.73 and negative likelihood ratio 0.15 [14].

This also resembles prospective study conducted by Henrichs *et al*. Two hundred and fifty-six pregnant women at term pregnancy who gave birth and had AC measurements taken. The mean gestational age was 39.1 ± 1.5 weeks, and macrosomia prevalence was 8.2% (21/256). A review of ROC curve indicated that AC 350 mm could identify macrosomic fetus. Area under curve (0.79 ± 0.04 to predict macrosomia). Likelihood ratio for AC to detect macrosomia is 2.9 [14].

Based on this research measurements, it was found that 15 maternal patients with macrosomia had AC >34.56 cm, while three pregnant women with macrosomia had AC <34.56 cm. The sensitivity of AC as diagnostic modality for mothers with macrosomia is 83%, while the sensitivity is 89% with cutoff value of

34.56 cm. This means that AC value >34.56 cm can detected 83% of total macrosomia cases and AC value >34.56 cm can diagnose 89% of total non-macrosomia mothers. Therefore, in this research, we can conclude that AC measurement can be used as a single marker in predicting macrosomia. Which AC measurement is easier to do and accurate enough to be used both at 37 weeks of gestation and intrapartum. Therefore, if AC is found >34.56 cm, complications that may occur in macrosomic babies can be anticipated.

The weakness of this research is AC measurements that are carried out by different observers therefore potency differences ability in one to another observer. Then, of 577 medical records of term pregnant women who gave birth at H. Adam Malik hospital Medan, only 18 cases of macrosomia were found. This indicates that macrosomia prevalence is only 3.11% while compared to macrosomia births presentation in Indonesia which reaches 6.4%. In the future, data with a larger sample are needed to get better sensitivity and specificity.

Conclusion

AC measurement is considered most effective method for predict baby's birth weight with fairly good level of sensitivity (83%) and specificity (89%).

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