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Umbilical artery colour Doppler in prediction of IUGR and its correlation with histopathology of placenta

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Abstract

Background: The study was conducted to evaluate the correlation of umbilical artery color Doppler and histopathology of placenta in prediction of IUGR.

Aims and Objectives

1. To determine the role of umbilical artery color Doppler in screening of high-risk mothers for detection of IUGR.
2. To understand the histopathological changes in the placenta of an IUGR.
3. To understand whether the changes in umbilical artery color Doppler correlate with histopathological changes in placenta of IUGR cases.

Material and Methods: The present study entitled "Umbilical Artery Colour Doppler in prediction of IUGR & its correlation with histopathology of placenta" was conducted in the Department of Obstetrics and Gynaecology, MGM Medical College and M. Y. Hospital, Indore (M.P) during the period of January 2017 to June 2018. Sample size 100.

Conclusion: Histopathological changes in placenta are gold standard for detection of IUGR. Sensitivity of umbilical artery color Doppler in prediction of IUGR is 90.9%, Specificity is 100%, Positive predictive value is 100% Negative predictive value is 85% and accuracy is 94%.

Keywords: IUGR, umbilical artery color doppler, histopathology of placenta

Introduction

The newborns with low birth weight, who are small for their gestational age and their weight are below the 10th percentile to their gestational age (SGA) are considered as infants with fetal growth restriction (FGR). IUGR is noted to affect approximately 10-15% of pregnant women [1]. The infant born with intrauterine growth retardation (IUGR) is recognized as having an increased risk of in utero mortality, neonatal morbidity and mortality and long-term neurological complications, recurrent infection, chronic disease (hypertension, hyperlipidemia, diabetes mellitus, coronary heart disease) later in life. Among the large numbers of maternal factors, maternal hypertension (especially preeclampsia or eclampsia) is one of the most important factors in IUGR [2, 3]. There is a strong association between reduced end-diastolic umbilical artery blood flow velocity and increased vascular resistance in the umbilical placental microcirculation [4, 5]. Placental insufficiency is the primary cause of intrauterine growth restriction in normally formed fetuses and can be identified using umbilical artery Doppler velocimetry [6-9]. Fetal growth and viability depends on the maternal supply of nutrients and oxygen through the placenta into the umbilical circulation. IUGR fetuses associated with increased risk of intrauterine fetal death, intracranial hemorrhage, respiratory distress syndrome, neonatal lung diseases, necrotizing enterocolitis, chronic cardiovascular disorders and renal diseases. The present study was undertaken to investigate the histopathological and radiological changes in the placentas of IUGR fetuses.

Aims and Objectives

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Material and Methods

The present study entitled "Umbilical Artery Colour Doppler in prediction of IUGR & its correlation with histopathology of placenta" was conducted in the Department of Obstetrics and Gynaecology, MGM Medical College and M. Y. Hospital, Indore (M.P) during the period of January 2017 to June 2018. This was a prospective study. The patients selected from IPD in Obstetrics and Gynaecology Department.

Sample size

100 patients

Inclusion criteria

- The LMP (Last menstrual period) of the patient -well known.
- Material age of 18-40 Yr
- Single pregnancy
- Patients with baby birth weight of <10th percentile of gestational age.
- Clinically diagnosed case of IUGR (based on findings such as insufficient weight gain, decrease in abdominal girth and decrease or no increase in fundal height).

Exclusion criteria

- Multiple pregnancies
- Congenital anomalies in the fetus

Refusal of inclusion by the patient

Study design

IUGR was taken as baby weight less than 10th percentile of their gestational age. Placenta with cord and membranes were collected immediately after delivery. The placentae along with the umbilical cord were preserved in 10% formalin and sent for histopathological examination. The placenta was examined for its colour, weight, diameter, thickness and number of cotyledons infarcted and calcified area. The cord examine for position of insertion and abnormality. The histopathological changes were recorded for placental villi and stromal changes.

Observations

Table 1: Histology of placental villi

Histology of placental villi	Present	Absent
Cytotrophoblastic Hyperplasia	61%	39%
Basement Membrane Thickening	66%	34%
Area of Fibrinoid Necrosis	56%	44%

Cytotrophoblastic Hyperplasia (61%), Basement Membrane Thickening (66%), Area of fibrinoid Necrosis (56%) were significantly higher in IUGR group.

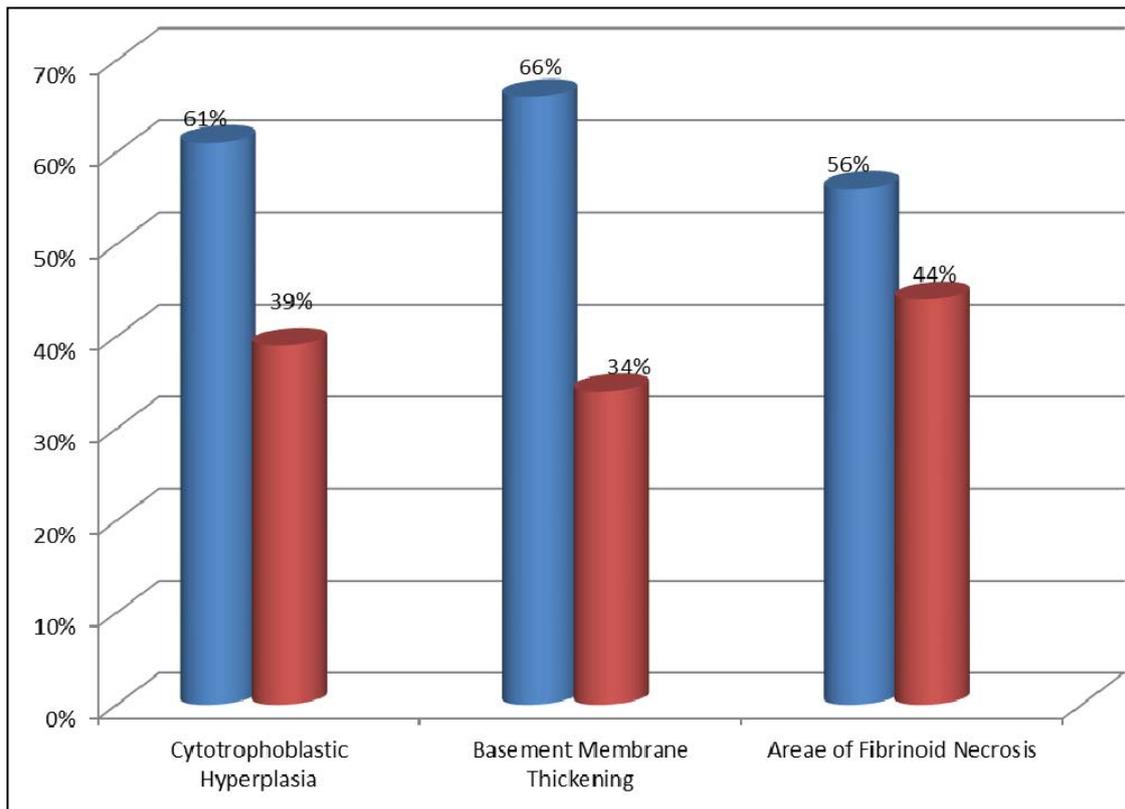


Fig 1: Histology of placental villi

Table 2: Umbilical artery doppler pulsatility index

Umbilical Artery Doppler pulsatility index	No of Patients(100)
Normal	34%
Increase	50%
Reversal Of Flow	16%

34% cases of IUGR show normal umbilical artery Doppler pulsatility index. 50% cases of IUGR showed increased umbilical artery Doppler pulsatility index (decreased blood flow in umbilical artery) suggestive of uteroplacental insufficiency. 16% cases of IUGR showed reversal of blood flow in umbilical artery Doppler suggestive the risk of sudden IUD.

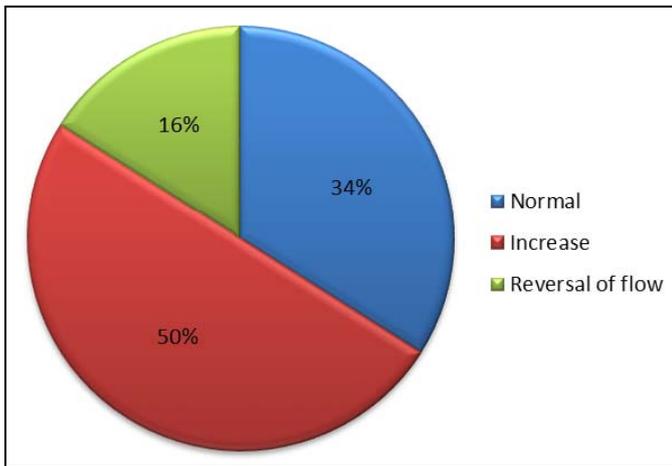


Fig 2: Umbilical artery Doppler pulsatility index

Table 3: Relationship between histopathological changes and umbilical artery color Doppler changes in IUGR

Umbilical artery color doppler changes	Histopathological changes	
	Positive	Negative
Positive	60%	0%
Negative	6%	34%
Total	66%	34%

In our study histopathological changes in placenta are gold standard for detection of IUGR. Sensitivity of umbilical artery color doppler in prediction of IUGR is 90.9%, specificity is 100%, positive predictive value is 100%, negative predictive value is 85% and accuracy is 94%.

Discussion

The present study was done to identify the histopathological changes in placenta of an IUGR and role of umbilical artery color Doppler in prediction of IUGR.

Placental infraction and calcification

Placental infraction occur in both IUGR placenta and normal placenta .But the infractions were severe and multiple in IUGR group. In our study placental infractions were found in 38% of the total cases of IUGR. Placental calcification occurred in both normal and IUGR placenta. In our study 59% of the total IUGR cases showed grade 2 calcification and 41% cases of IUGR showed grade 3 calcification.

Kana Bal *et al.* [11] conducted a study, which shows that chances infraction in IUGR placenta was 1.9 times (90%) higher than control group and chances calcifications in IUGR placenta was 1.6 times (60%) higher than control group.

Histology of placental villi

In our study 61% cases of IUGR (100cases) showed cytotrophoblastic hyperplasia, 66% cases of IUGR (100cases) showed basement membrane thickening,56% cases of IUGR (100cases) showed fibrinoid necrosis, 67% cases of IUGR (100cases) showed intervillous fibrin deposition, 61% cases of IUGR (100 cases) showed squamous metaplasia,85% cases of IUGR showed syncytial knot formation.

Mardi Kavita *et al.* [12] conducted a study on histopathological changes of an IUGR placenta, the results of this study are – Intervillous fibrin deposition (64%), basement membrane thickening (40%), cytotrophoblastic hyperplasia (44%), hypovascular villi (32%), increased syncytial knotting (64%), fibrinoid necrosis of villi (20%).

Umbilical artery doppler pulsatility index

The gradual changes in diastolic flow of umbilical artery like decrease, absent, reversed. This changes were significantly correlate with severity of fetoplacental insufficiency. In our study 34% cases of IUGR showed normal umbilical artery Doppler pulsatility index.50% cases of IUGR showed increase umbilical artery Doppler pulsatility index (decrease blood flow in umbilical artery) which is suggestive of uteroplacental insufficiency. 16% cases of IUGR showed reversal of blood flow in umbilical artery Doppler which is an ominous sign for foetus.

Tannindron *et al.* [13] found that the absence of diastolic flow in umbilical artery is often associated with adverse outcome of pregnancy e.g. IUGR and fetal hypoxia. Reversal of diastolic flow in umbilical artery shows a strong correlation with fetal hypoxia and acidosis leads to sudden IUD.

Relationship between histopathological changes and umbilical artery color Doppler

In our study histopathological changes in placenta are gold standard for detection of IUGR. Sensitivity of umbilical artery color Doppler in prediction of IUGR is 90.9%, Specificity is 100%, Possitive predictive value is 100%, and negative predictive value is 85% and accuracy is 94%.

Conclusion

Histopathological changes in placenta are gold standard for detection of IUGR. Sensitivity of umbilical artery color Doppler in prediction of IUGR is 90.9%, Specificity is 100%, Possitive predictive value is 100%, negative predictive value is 85% and accuracy is 94%.

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