

MID-TRIMESTER UTERO PLACENTAL DOPPLER ARTERIAL ULTRASOUND STUDY AS INDICATOR OF ADVERSE OBSTETRIC OUTCOME IN HIGH –RISK PREGNANCY

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ABSTRACT--The objective of this study was to evaluate utero artery Doppler ultrasound efficiency in adverse pregnancy outcome prediction among high-risk pregnant women in Mosul city. where 60 pregnant women who were high risk for development of preeclampsia, placenta abruption, low weight of the born were selected and early labor during their pregnancy, and Doppler ultrasound was conducted for these women in 18-24 gestational weeks to assess utero artery notching. In this study notching was defined as the lack of diastolic flow in utero artery waves. The patients were distributed into two groups: (Group A, n= 27) represented women who had notch , (Group B n=33) represented women who had didn't had notch. The study concluded many results from them: The weight of the new born in Groups A and B was 2091 and 3025 gm, respectively. In our study, 11 cases were delivered before 37 weeks (early labor). Preeclampsia, placenta abruption, and low weight of the born were significantly higher in the group (A) other than group (B), but there is no significant differences regarding early labor the two groups. Based on the results, utero artery ultrasound had high NPV in predicting of preeclampsia, abruption, and low weight of the born, thus evaluate presence or absence of notching in mid-trimester by using utero artery ultrasound for high-risk pregnant ladies could enhance the outcome adverse obstetric outcome. So the current study recommends Doppler ultrasound usage in high-risk pregnancy cases in mid-trimester for pregnancy outcome prediction.

Keywords--Utero artery Doppler ultrasound, adverse obstetric outcome, high-risk pregnancy.

I. INTRODUCTION

By looking at medical history of gestation and obstetric , it could be found that the common causes for high –risk pregnancy are hypertension and preeclampsia , where the possibility of having Eclampsia among women who had such history is estimated by eleven times more than healthy women ⁽¹⁾

Uterine arteries as well as ovarian arteries are considered as the main blood supply to the uterus. However arterial vessels divide into minute arteries when they reach to uterine muscle, then they branch to radial arteries that finally distribute into spiral ones . trophoblast provide the spiral arteries in first and second trimester of pregnancy, it is a natural process for normal placenta formation

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(2) An abnormal placental growth in the uterus leads to over flow of blood resistance in the utero artery flow speed in the form of wave⁽³⁾. As well as it is known that determination of these perinatal problems before they become clinically overt, might may leads to enhance outcome by more focused antenatal surveillance or intervention with therapies such as aspirin or antioxidants that could potentially modify the underlying pathophysiology⁽⁴⁾, so, we need to investigate the flow in the umbilical artery accurately among high-risk pregnant women for checking of possible asphyxia of the fetus whether it was acute or chronic, and it in turns leads to exploring any other related complications⁽⁵⁾.

One of the famous methods to conduct these mentioned investigation is, Doppler arterial ultrasound, hence the ultrasound flow imaging capacities have been increased recently and color flow imaging is now familiar for instance, 'power' or 'energy' Doppler introduces new techniques for imaging flow. diagnosis of the placental circulation by Doppler have a significant importance in screening impaired placenta formation, and its other associations such as pre-eclampsia, growth restriction inside uterus and prenatal death⁽⁶⁾, thus the current study select using of utero placental Doppler arterial ultrasound study as indicator of adverse obstetric outcome in high-risk pregnancy.

II. MATERIALS AND METHODS

The current research used a prospective analytical approach for High-risk pregnant ladies who were visiting a private Ultrasound clinic in Mosul city, the research continued for four years between May 2015 to May 2019. the gestational age of the selected patients had been ranged between 18-24 weeks, which represents the mid-trimester & The chosen high risk pregnancy women had been selected according to the following factors:

- (1) hypertension;
- (2) gestational diabetes,
- (3) Pre-existing renal disease;
- (4) Systemic lupus erythematosus
- (5) Anti phospholipid syndrome
- (6) Previous recurrent pre-eclampsia
- (7) Previous early-onset pre-eclampsia requiring delivery
- (8) intrauterine fetal death

An assessment of uterine artery notching was conducted for the pregnant women in pregnancy period between 18-24 weeks, using Doppler arterial ultrasound with 2-5 MHz power adaptor

Notching in uterine artery was determined within the absence of diastolic flow in uterine artery waves. Uterine and umbilical arteries were investigated by using Doppler flow velocity wave examination, However Umbilical artery blood speed signals were gained and analyzed depending on free floating central waveforms to get S/D ratio. Besides maximum blood speed spectra of umbilical artery are classified to four sub-quantitative blood flow classes depending on the waveform mode, after modify the blood flow⁽⁷⁾:

- Class (0) Normal S/D ratio less than 3 (shown in image 1)
- Class (1) High ratio above 3 but the flowing was normal regarding diastole
- Class (2) blood flow in case when diastole didn't appear

Class (4) blood flow in case when diastole was reversed

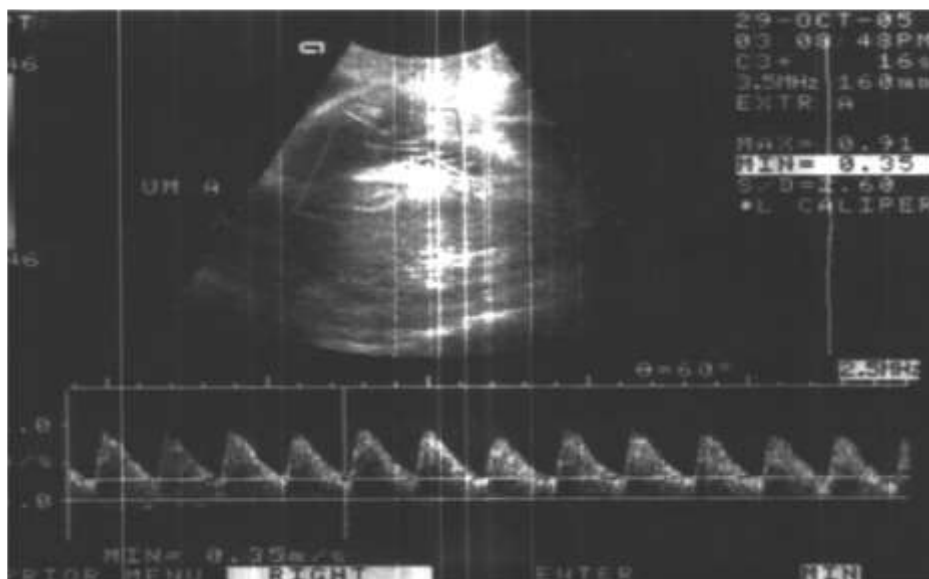


Figure 1: taken by Doppler arterial ultrasound to show normal flow regarding diastole (the S/D ratio = 2.69),

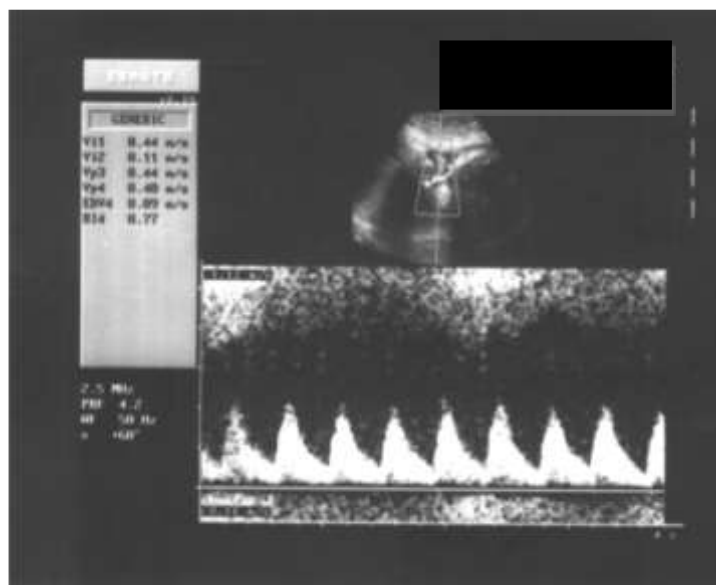


Figure 2: taken by Doppler arterial ultrasound to show up-normal flow regarding diastole (the S/D ratio = 4.3),

By using maps for colored flow, uterine arteries were determined within inclined scan, the speed of blood flow in the artery was recorded. Moreover, the velocity of utero blood flow waveforms have been classified into five degree based on increased pulsatility index and or an early diastolic notch ⁽⁸⁾

Degree (0) referred to blood velocity is normal in arteries (image3)

Degree (1) referred to presence of only one abnormal indicator (high pulsatility index or notching) (image 4)

Degree (2) referred to presence of two abnormal indicators

Degree (3) referred to presence of three abnormal indicators

Degree (4) referred to presence of four abnormal indicators (i.e., high pulsatility index and notch in both arteries).

Here in this study, the degree (0) and (1) were considered (shown in the next images), to determine the velocity of utero blood flow waveforms and thus determine also the presence of notching among the high-risk cases.

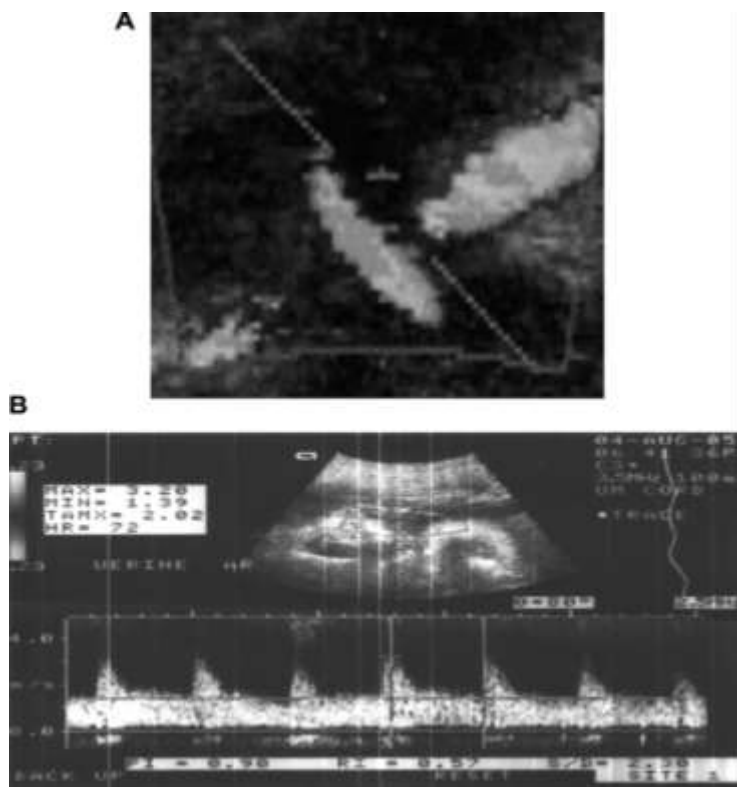


Figure 3: (A) Technique of measuring uterine artero velocity : the volume of the sample is estimated directly to the cross-over of iliac artery before the utero artery distribution into minute arteries
(B) utero artery Doppler in normal case while pulsatility index (0.90).

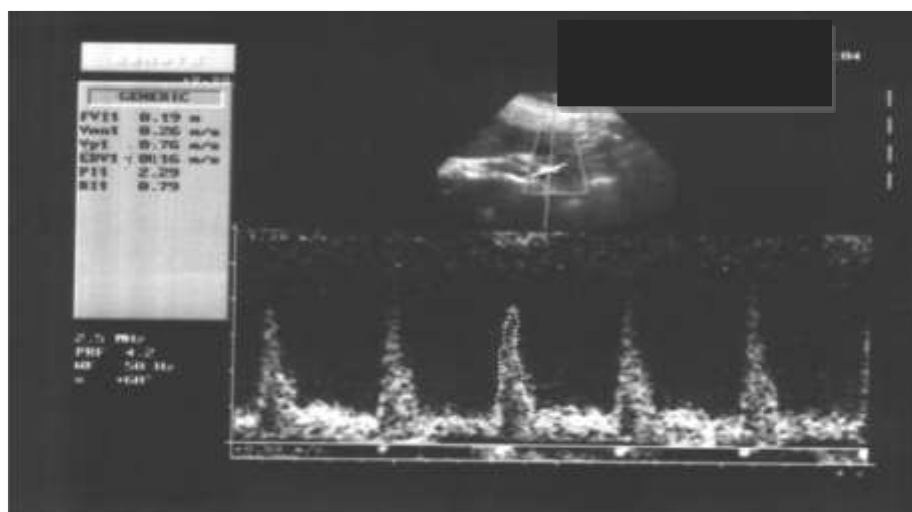


Figure 4: abnormal indicator (high pulsatility index = 2.3 or notching) for utero artery Doppler

Both utero arteries were investigated to detect presence of a systolic or diastolic notch (at least one side of the uterus). Where ,a systolic notch means any momentary decline in the rate of maximal flow velocity during the decelerative phase of the systolic wave , however , a diastolic notch means any decrease in the maximal flow velocity below the maximum diastolic velocities, occurring just after the systolic wave ⁽⁹⁾

The research used a questionnaire to collect information that obtained from Doppler ultrasound technique both demographic or clinical, after that the pregnant women who were subjected to the investigation were distributed to two groups depending on presence or absence of notch in their utero Doppler arterial ultrasonography Group A(women having notch) , Group B (women haven't notch)

All patients were subjected to medical care until delivery time, where prenatal care and therapeutic procedures were performed, but regarding any complications that occurred in pregnancy, they have been recorded in the questionnaire,such as preeclampsia, Abruption of placenta , low birth weight ,and early labor

We also defined preeclampsia as hypertension which equal or above 140/90 mm hg , both hypertension , systolic and diastolic were considered in pregnant cases that hadn't any medical history of hypertension , they had protein estimated by 290 mg or albumin (≤ 1) in 24-h urine , the examination was made randomly ⁽¹⁰⁾

Also, in this research, we defined complication of low birth weight as weight which below 2.500 gm for the new born. Regarding early labor , it refers here to delivery cases that occur before 37 weeks from pregnancy period. While we excluded the multiple pregnancy cases from our study . To analyze the data , the Statistical Package for the social sciences program (SPSS) was used. Were the t test for independent samples was used , and to analyze the categorical data , the χ^2 and Fisher tests were used , to determine Statistical significance the (p) value < 0.05 was taken into account . This study followed WHO instructions and conditions.

III. FINDINGS

Study demographic and medical information was collected by examination of high-risk cases of pregnant women, as 60 women, who were subjected to utero placental Doppler arterial ultrasonography were selected , in the gestational age ranged between 18th-24th weeks (mid – trimester) (shown in table 1)

Table 1: risk factors percentage among pregnant women

The factor	N	Percentage
hypertension	11	18.3%
gestational diabetes,	9	15%
pre-eclampsia;	8	13.3%
Chronic diabetes,	7	11.66%

early-onset pre-eclampsia requiring delivery	7	11.66%
intrauterine fetal death	8	13.3%
Anti-phospholipid syndrome	2	3.3%
Systemic lupus erythematosus;	2	3.3%
placental abruption	6	10%

From the previous table, it could be concluded to, the hypertension ranked as the first risk factor among high risk pregnancy women ,which was 11 patients from 60 women , followed by gestational diabetes, Which was found in 9 cases , then pre-eclampsia which in turns found in 8 cases , while some factors present in low rate such as Anti phospholipid syndrome and Systemic lupus erythematosus which recorded in 2 cases for both factors .

While the demographic data of the sample depending on presence of notch in utero artery Doppler are shown in table (2) as a total and in two groups , group A represents the women having notching in utero artery in Doppler examination and Group B represents the women haven't notching . In the current study , the resreacher need to make characteristics of two groups equal, such as age , weight , to be sure there is no significant differences in such variables , this is shown in table 2 also .

Table 2: The main characteristic of high-risk pregnant women in Group A&B based on utero artery Doppler examination

Character	Group A		Group B		Total		pb
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	
Age by year	28.67	6.2	27.98	5.6	29.1	6.3	0.35
Body mass index	25.9	2.98	25.9	3.7	26.8	2.99	0.872
Gravidity (n)	1.9	0.91	2	1.2	1.99	1.1	0.699
Weight of the born	2.91	756..2	3.25	3.75	3.23	572.1	0.330

Among women with high –risk pregnancy The number of pregnant women who had notching represented Group A was 26 by percentage (43.33%) , and the number of Group (B) who hadn't notching was 33 (55%) . There are significant differences between Group A and Group B regarding some factors especially preeclampsia, placental abruption and low weight of the born , while there is no any significant difference between the two groups regarding early-onset pre-eclampsia requiring delivery , Also, the weight of new born in Group A was significantly lower than that of Group B . these results shown in table (3)

Table 3: adverse obstetric outcome in high –risk pregnancy

adverse obstetric outcome	Cases with notching N=26	Cases without notching N= 33	P value	Sensitivity	Specificity	positive predictive value.	negative predictive value
preeclampsia	11 (42.3 %)	6(13%)	0.002	70.9	72.8	47.99	87.6
placental abruption	3(11.5%)	0 (0%)	0.021	100	64.98	15.1	100
low weight of the born (<2.500 gm.)	5(19.23 %)	1(3%)	0.006	88	69.90	33	98
early labor	7(26.9%)	4(12.1 %)	0.059	67	70	36	89

IV. DISCUSSION

In this study ,among the sample of 60 pregnant women who had high-risk factors within the gestational period ranged between 18-24 weeks , undergo Doppler ultrasonography there are increase in the rate of placental abruption , preeclampsia and low weight of the born , this increase was related to presence of notching of utero artery , also there was 43% of high –risk cases had notching which in turns appeared through investigations through Doppler ultrasound of at least one utero artery within pregnancy mid-trimester (18-24 weeks) .This results Consistent withEl- Hamedi study ⁽¹¹⁾ , where it proved the increase of preeclampsia and low weight of born significantly among pregnant women who had notching.

In this study, only 13% of high-risk cases who hadn't notching had preeclampsia, whereas in cases with notching this percentage was 42%, thus these results could be taken as an indicator in predicting preeclampsia and patient follow-up this agrees with GEIPEL el al study ⁽¹²⁾

Also , regarding for preeclampsia , the positive predictive value of these test was about 47.99 % and the negative predictive value estimated by 87%. But in El-Sayed el al ⁽³⁾ . the sensitivity, specificity, , NPV of resistive of umbilical artery were 70%, 60%, 54.7%, 58.3%, 63% respectively

regarding the investigation of preeclampsia, in our study, a study conducted by El-Hamid el al ⁽¹³⁾ notching was recorded in both utero artery , and the women had early labor before 37 w, but in the current study all cases with preeclampsia with utero artery notching are recorded .

regarding early labor, in this study recorded 30% of cases with notching and 12% among cases without notching , this other than Vainio et al⁽¹⁴⁾ that concluded about 10% of cases were recorded among women without arterial notching regarding preeclampsia or early-onset pre-eclampsia requiring delivery. As well as , low weight of born and placenta abruption as risk factors had high statically significant among high risk pregnant women with notching within the pregnancy period ranged between 18-24 weeks (mid-trimester) , while positive

predictive value for these factors were 33% , 15% respectively referred to relatively low values , these decrease may due to Complications related to the mentioned two factors . In this study, although the high rate of early labor in cases with notching, but there was no statistically significant difference between Group A & B. Which referred to that utero artery Doppler ultrasound at mid- trimester has the ability to predict the complications of blood supply problems between placenta and fetus only .

V. CONCLUSION

Eventually, utero arteries Doppler ultrasound has high positive value regarding the prediction of preeclampsia, placenta abruption, and low weight of new born fetus

Thus depending on these technique & their parameters, we can determine within mid-trimester of pregnancy any complications resulted from high-risk pregnancy factors, and thus get outcomes with low adverse obstetric complications depending on arterial Doppler parameters

as well as the value & presence of arterial notching in mid-trimester made much more complications & adverse pregnancy outcome higher than the value of non-notching Doppler arterial signal cases using utero artery Doppler study which indicated the validity of this metho this also indicated & done by many other studies ^{(16,17 18}

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