Med. J. Cairo Univ., Vol. 90, No. 2, March: 527-535, 2022
www.medicaljournalofcairouniversity.net

The Role of Fetal Pulmonary Artery Doppler in Prediction of Fetal Lung Maturity

MOUNIR S. GUIRGUIS, M.D.; NARDEEN B. ATTA, M.Sc. and SUZAN F. IBRAHIM, M.D.

The Department of Radio-diagnosis, Faculty of Medicine, A in Shams University

Abstract

Background: The pulmonary system is the last fetal organ system required for extra uterine life to become functionally mature, and respiratory distress syndrome (RDS), related to pulmonary surfactant deficiency, remains a major morbidity and mortality.

Aim of Study: Was to emphasize the role of fetal pulmonary artery Doppler in prediction of fetal lung maturity by comparing fetal pulmonary artery color Doppler results with gestational age and neonatal outcome.

Patients and Methods: This observational prospective cross sectional study was conducted at Ain Shams University Obstetricians & Gynecologists Hospital after approval from the hospital research ethics committee for 8 months. The study included sixty pregnant women aged 18-41 years between 28 to 40 weeks gestational age of pregnancy, had been admitted for elective cesarean, or attending the delivery unit either in active labor or indicated for selective cesarean. Ultrasound scans were performed within 48 hours for pregnant women from 28 weeks to 40 weeks.

Results: Main pulmonary artery (At/Et ratio), fetal lung to liver echogenicity, free particles in amniotic fluid and placental grading were positively correlated with lung maturity. It identified main pulmonary artery At/Et ratio (cutoff ≥0.30) with (92.5% sensitivity, 87.2% specificity), as reliable predictors of neonatal RDS. Also our study showed that gestational age, free particles of amniotic fluid, fetal lung to liver echogenicity and placental grading were significantly correlated with development of neonatal respiratory distress syndrome as gestational age was lower on those who eventually developed neonatal RDS (p-value <0.001). Furthermore, combination of these measures has greater sensitivity & negative predictive value than when either measure was used alone. Therefore, these measurements might be alternatives to invasive procedures for assessment of fetal lung maturity before delivery.

Conclusion: Main pulmonary artery (MPA) At/Et ratio, together with fetal lung to liver echogenicity, free particles in amniotic fluid and placental grading can be used as non-invasive accurate methods for prediction of neonatal respiratory distress syndrome (RDS) and fetal lung maturity (FLM), with even higher sensitivity and predictive values when in-combined. Main pulmonary artery At/Et showed significant difference between fetuses developing RDS and those who did not, but it's recommended to be combined to the other measurements, as alone it shows lower specificity along the different gestational age (GA).

Key Words: *Fetus – Pulmonary artery – Doppler – Fetal – Lung maturity.*

Correspondence to: Dr. Nardeen B. Atta,
E-Mail: www.Nardoboshra779@gmail.com

Introduction

APPROXIMATELY 7.3% of all live births in Egypt are premature (birth before 37 weeks of gestation). Some preterm deliveries are sometimes, provider initiated and others can be unintentionally preterm because of gestational age (GA) error as commonly seen in women delivered by elective caesarean section (CS) **[1]**.

Fetal lung maturity is the key factor for the survival of prematurely delivered newborn baby; therefore, knowledge of the fetal lung maturity is helpful to make the decision of continuation or termination of pregnancy **[2]**.

Determination of fetal lung maturity traditionally was relied on amniocentesis and measurement of component proteins and lipid in the amniotic fluid **[3]**.

However, amniocentesis is an invasive procedure and was recommended for specific indications, thus, non invasive methods using ultrasound to assess fetal lung maturity have been thought for **[4]**.

The Doppler effect has allowed the characterization of several vessels in maternal-fetal circulation that have been used for practical proposes **[5]**.

Doppler velocimetry provides a simple and non invasive method to assess the fetal pulmonary circulation **[5]**.

Aim of the work:

The aim of this work was to emphasize the role of fetal pulmonary artery Doppler in prediction of fetal lung maturity by comparing fetal pulmonary artery color Doppler results with gestational age and neonatal outcome.

Patients and Methods

Observational prospective cross sectional study was conducted at Ain Shams University Obstetricians & Gynecologists Hospital for 8 months from Feb. 2021 – Nov. 2021. And was approved by the hospital research ethics committee.

Participants:

Sixty pregnant women aged 18-41 years between 28 to 40 weeks gestational age of pregnancy, had been admitted for elective cesarean, or attending the delivery unit either in active labor or indicated for selective cesarean. The study included women with a singleton uncomplicated pregnancy, gestational age (GA) was calculated from the last menstrual period or by first-trimester ultrasound (28 to 40 weeks GA) and fetuses delivered within 48 hrs of ultrasound scan.

While women with any pregnancy-related diseases (e.g. hypertension, preeclampsia, or diabetes mellitus, autoimmune disorders), due to fetal condition: Twin pregnancies, cases of congenital fetal anomaly, macrosomia or intrauterine growth restriction were excluded from the study.

After obtaining an informed consent from the participants, a complete history was taken & ultrasound examination was performed.

Study tools and procedure: All the patients of our study were subjected to the following:

- Full History taking: Asking for maternal age, chronic disease, last menstrual period, any complication during pregnancy and parity.
- Real time ultrasound: Examination was performed using 3.5-5 MH B-mode transducer. The protocol consisted of obtaining gestational age (GA), femur length (FL), biparietal diameter (BP), abdominal circumference (AC), amniotic fluid index (AFI), Free floating particles in the amniotic fluid, expected fetal weight (EFW), placental grading and fetal lung-to-liver echogenicity.
- Color Doppler ultrasound: Examination was performed using 3.5-5 MH matched imaging and Doppler frequency transducer. The protocol was consisting of obtaining fetal main pulmonary artery (MPA) resistance index (RI), pulsitile index (PI), acceleration time (AT), ejection time (ET) and the acceleration/ejection time At/Et ratio.

Doppler measurements were obtained at a physiologic fetal heart rate of 120-160 beats/min in the absence of maternal or fetal body and breathing movements. The examiner examined the fetal heart in a systematic manner (the four-chamber view, the outflow tracts and the three-vessel view).

The pulmonary artery was visualized in a transverse section of the fetal chest at the level of the 4-chamber view of the heart, rotating the transducer from the 4-chamber view to the short axis view of the heart, then angling the transducer cranially and the pulmonary artery was followed until the bifurcation of the right and left branches came into view.

Color Doppler was used, to adjust the ideal Doppler parameters (ie. Scale, color gain, filter) then turned off as it causes blue and red overlapping colors, which would obscure the fetal pulmonary artery, then Pulsed Doppler was introduced and the sample volume was focused on the pulmonary artery stem.

The sample volume was placed over the artery directly depending on the sonographic anatomy, the pulsed Doppler sample gate was adjusted to 2-4mm. Doppler scale & baseline were adjusted for optimal velocity waveform display clearly showing the peak systolic velocity (PSV) and early diastolic notch, the image was not frozen until there were at least five continuous stable Doppler waves. Differentiation from the ductus arteriosus waveform was important to avoid error.

After the optimal fetal main pulmonary artery wave form was obtained, relevant Doppler velocity variables were manually traced three times and the average was taken. The variables included the PI, RI and At/Et ratio. To obtain the At/Et ratio, the time interval from the beginning of the ventricular systole to the achievement of peak velocity acceleration time was divided by the time interval from the beginning to the end of ventricular systole ejection time.

Postnatal clinical examination: Upon delivery, The clinical outcome and data of all fetuses was abstracted from the medical records, including gestational age at delivery, route of delivery, birth weight, fetal gender, neonatal intensive care unit (NICU) admission, and presence or absence of respiratory distress syndrome (RDS). The diagnosis of RDS was based on clinical signs of respiratory distress (tachypnea, retractions and/or nasal flaring),

supplemental oxygen requirement for at least 24hrs, typical chest X-ray findings with reticulogranular patterns, air bronchograms and ground glass appearance.

Neonatal respiratory distress syndrome was diagnosed by pediatricians who were blinded to the fetal MPA Doppler form measurements.

Statistical analysis:

Recorded data were analyzed using the statistical package for social sciences, version 20.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data were expressed as mean ± standard deviation (SD). Qualitative data were expressed as frequency and percentage. The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the *p*-value was considered significant as the following: *p*-value <0.05 was considered significant.

Results

Table (1): GA "wks." Descriptive among study group (n=60).

GA (wks)	Total (n=60)
Range	29-40
Mean±SD	36.80±3.15

The study was conducted on a wide GA ranging from 29 to 40 wks, (mean GA of 36.8±3.15 wks).

Table (2): Placental grading distribution among study group (n=60).

Placental grading	No.	%
II	32	53.3
III	28	46.7
Total	60	100.0

There were 32 patients (53.3%) of them had "grade II" and 28 patients (46.7%) of them had "grade III" among placental grading.

Table (3): AF free particles distribution among study group (n=60).

AF free particles	No.	%
Negative	28	46.7
Positive	32	53.3
Total	60	100.0

There were 28 patients (46.7%) of them had "negative" and 32 patients (53.3%) of them had "positive" among AF free particles.

Table (4): FLL echogenicity distribution among study group (n=60).

FLL echogenicity	No.	%
Hyper	42	70.0
Iso	12	20.0
Hypo	6	10.0
Total	60	100.0

There were 42 patients (70%) of them had "hyper", 12 patients (20%) of them had "Iso" and 6 patients (10%) of them had "Hypo" among FLL echogenicity.

Table (5): Neonatal respiratory distress syndrome distribution among study group (n=60).

Neonatal respiratory distress syndrome	No.	%
Positive	26	43.3
Negative	34	56.7
Total	60	100.0

There were 26 patients (43.3%) of them had "positive" and 34 patients (56.7%) of them had "negative" among neonatal respiratory distress syndrome.

Table (6): Resistance index (RI), Pulsitile index (PI) and AT/Et ratio descriptive among study group (n=60).

Doppler	Range	Mean ± SD
Resistance index (RI)	0.54-0.99	0.80±0.13
Pulsitile index (PI)	1.52-3.45	2.37±0.63
AT/Et ratio	0.18-0.35	0.27±0.05

The study was conducted on a wide Resistance index (RI) ranging 0.54-0.99 with mean of 0.80 ± 0.13; Pulsitile index (PI) ranging 1.52-3.45 with mean of 2.37±0.63; the table also clarified that, AT/Et ratio ranging 0.18-0.35 with mean of 0.27 ± 0.05.

Table (7): Comparison between RDS Group and No-RDS Group according to GA.

GA (wks)	RDS Group (n=26)	No-RDS Group (n=34)	Test value	*p*-value
Mean±SD	37.15±2.85	36.53±3.38	0.758	0.451
Range	31-40	29-40		

Using: Independent Sample *t*-test. *p*-value >0.05 NS.

The two groups were comparable in GA with the mean ± SD in each of RDS group and No-RDS group was 37.15±2.85 compared to 36.53 ±3.38 respectively, as there is no statistically significant difference between groups with *p*-value (*p*=0.451).

Table (8): Comparison between RDS Group and No-RDS Group according to placental grading.

Placental grading	RDS Group (n=26)	No-RDS Group (n=34)	Test value	*p*-value
II	24 (92.3%)	8 (23.5%)	28.003	<0.001**
III	2 (7.7%)	26 (76.5%)		

Using: Chi-square test. ***p*-value <0.001 HS.

The results showed 32 patients out of 60 having placental grade II, 24 patients (92.3%) belong to RDS group and 8 patients (23.5%) belong to No-RDS group. In 28 patients was Placental grade III, from which 2 patients (7.7%) belong to RDS group and 26 patients (76.5%) belong to No-RDS group, as there was statistically significant difference between RDS group and No-RDS group according to placental grading with *p*-value ($p<0.001$ HS).

Table (9): Comparison between RDS Group and No-RDS Group according to AF free particles.

AF free particles	RDS Group (n=26)	No-RDS Group (n=34)	Test value	*p*-value
Negative	24 (92.3%)	4 (11.8%)	38.402	<0.001**
Positive	2 (7.7%)	30 (88.2%)		

Using: Chi-square test. ***p*-value <0.001 HS.

The results showed 28 patients out of 60 having negative AF free particles, 24 patients (92.3%) belong to RDS group and 4 patients (11.8%) belong to No-RDS group. In 32 patients was positive AF free particles, from which 2 patients (7.7%) belong to RDS group and 30 patients (88.2%) belong to No-RDS group, as there was highly statistically significant difference between RDS group and No-RDS group according to AF free particles with *p*-value ($p=0.002$ S).

Table (10): Comparison between RDS Group and No-RDS Group according to FLL echogenicity.

FLL echogenicity	RDS Group (n=26)	No-RDS Group (n=34)	Test value	*p*-value
Hyper42	12 (46.2%)	30 (88.2%)	12.877	0.002*
Hypo6	4 (15.4%)	2 (5.9%)		
Iso 12	10 (38.5%)	2 (5.9%)		

Using: Chi-square test. **p*-value <0.05 S.

The results showed 42 patients out of 60 having hyper, 12 patients (46.2%) belong to RDS group and 30 patients (88.2%) belong to No-RDS group. In 6 patients was hypo, from which 4 patients (15.4%) belong to RDS group and 2 patients (5.9%) belong to No-RDS group. In 12 patients was Iso, from which 10 patients (38.5%) belong to RDS group and 2 patients (5.9%) belong to No-RDS group, as there was statistically significant difference between RDS group and No-RDS group according to FLL echogenicity with *p*-value ($p=0.002$ S).

Table (11): Comparison between RDS Group and No-RDS Group according to Resistance index (RI) and Pulsitile index (PI).

Doppler	RDS Group (n=26)	No-RDS Group (n=34)	Test value	*p*-value
Resistance index (RI):				
Mean ± SD	0.78±0.13	0.81±0.13	–0.971	0.336
Range	0.54-0.95	0.56-0.99		
Pulsitile index (PI):				
Mean ± SD	2.27±0.74	2.45±0.54	–1.111	0.271
Range	1.52-3.45	1.71-3.34		

Using: Independent Sample *t*-test.
p-value >0.05 NS.

Average of Resistance index (RI) was 0.78 ±0.13 for the RDS group compared to 0.81 ±0.13 for the No-RDS group; with *p*-value 0.383 indicating insignificant difference between the two groups.

As for the, average of Pulsitile index (PI) was 2.27±0.74 for the RDS group compared to 2.45 ± 0.54 for the No-RDS group; with *p*-value 0.271 indicating insignificant difference between the two groups.

Table (12): Comparison between RDS Group and No-RDS Group according to AT/Et ratio.

AT/ET ratio	RDS Group (n=26)	No-RDS Group (n=34)	Test value	*p*-value
Mean±SD	0.23±0.04	0.30±0.03	–7.042	<0.001**
Range	0.18-0.3	0.21-0.35		

The patients AT/ET ratio in patients with RDS group ranged from 0.18-0.3 with (mean 0.23 ±0.04), compared to No-RDS ranged from 0.21-0.35 with (mean 0.30±0.03), there was highly significant lower mean in RDS group compared to No-RDS with *p*-value ($p<0.001$ highly Significant).

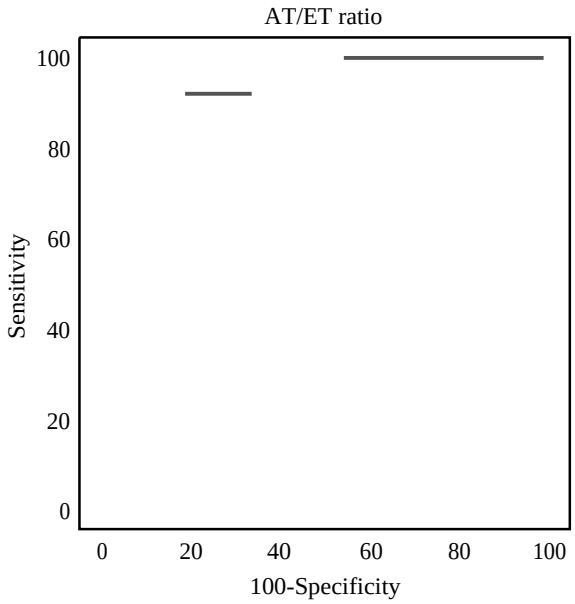

Fig. (1): Receiver operating characteristic curve, sensitivity, specificity, positive predictive value, negative predictive value, and accuracy for At/Et ratio in prediction of fetal lung maturity.

Cut-off	Sen.	Spe.	PBB	NPV	Accuracy	*p*-value
≥0.30	92.3%	82.4%	80%	93.3%	0.898	<0.001

Receiver operating characteristics (ROC) curve was performed for At/Et ratio and demonstrated an area under the curve of 0.898 (0.793-0.961) with *p*-value <0.0001. The best cut off value for prediction of good CRT response was ≥0.30 with sensitivity 92.3% and specificity 82.4%.

Pregnant female 32 years old, LMP not detected, MG, 30 weeks 5 days gestational age. Came to the emergency department with vaginal bleeding (placenta previa), Positive history of steroid intake.

2D US:

- FL: 29 wks 3ds.
- AC: 30 wks 5ds.
- BP: 31 wks 6ds.
- EFW: 1596gm.
- GA: 30 wks 5ds.
- AFI: 11 cm.
- Free floating particles in amniotic fluid: Absent.
- Placental grading: Grade II.
- Fetal lung to liver echogenicity: Hypoechioc.

MPA Doppler:

- PI=1.52.
- RI=0.86.
- AT=87.10.
- ET=335.01.
- At/Et ratio=0.26.

Neonatal outcome:

- Mode of delivery: CS
- NBW: 1453gm.
- Sex: Female.
- NICU admission: Yes.
- Clinical diagnosis: RDS.

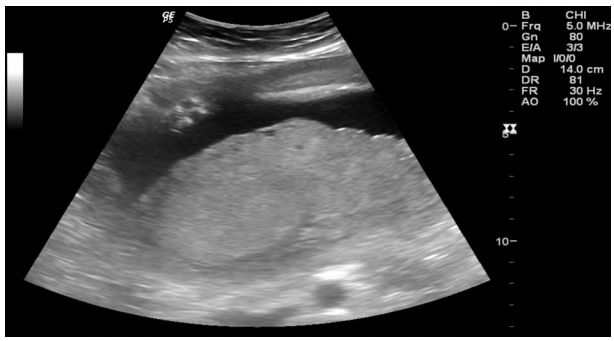

Fig. (2): 2D ultrasound showing posterior placenta grade II and clear amniotic fluid with absence of free floating particles.

Fig. (3): 2D ultrasound showing hypoechioc echogenicity of fetal lung to liver.

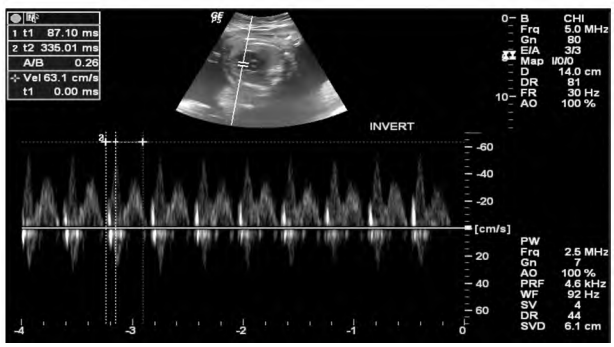

Fig. (4): Measurements of the MPA AT, ET and AT/ET ratio using pulsed wave Doppler.

Pregnant female 24 years old, LMP not detected, PG, 37 weeks 1 day gestational age. Came to the obstetric department for elective caesarean delivery, Positive history of steroid intake.

2D US:
- FL: 38 wks 1d.
- AC: 36 wks 1d.
- BP: 37 wks 1d.
- EFW: 3092gm.
- GA: 37 wks 1d.
- AFI: 13cm.
- Free floating particles in amniotic fluid: Present.
- Placental grading: Grade III.
- Fetal lung to liver echogenicity: Hyperechioc.

MPA Doppler:
- PI=1.55.
- RI=0.82.
- AT=93.80.
- ET=268.01.
- At/Et ratio=0.35.

Neonatal outcome:
- Mode of delivery: CS.
- NBW: 2993gm.
- Sex: Male.
- NICU admission: No.
- Clinical diagnosis: No RDS.

Fig. (5): 2D ultrasound showing clear amniotic fluid with presence of free floating particles.

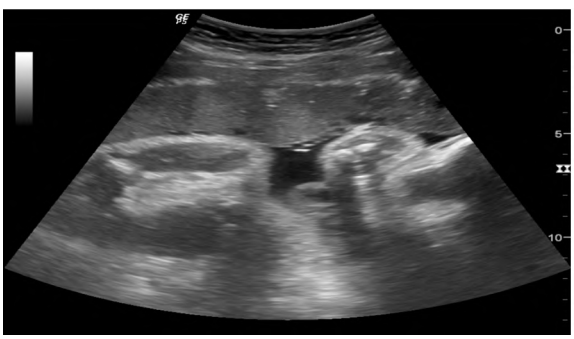

Fig. (6): 2D ultrasound showing anterior placenta with calcifications and lacunar changes grade III.

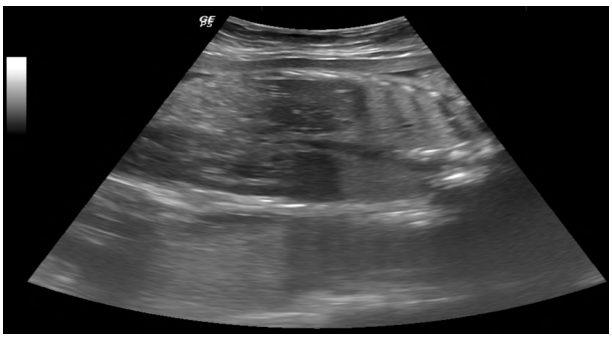

Fig. (7): 2D ultrasound showing hyperechioc echogenicity of fetal lung to liver.

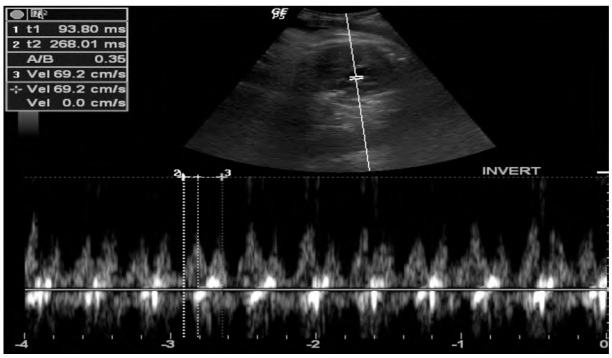

Fig. (8): Measurements of the MPA AT, ET and AT/ET ratio using pulsed wave Doppler.

Discussion

Respiratory distress syndrome is one of the most important causes of mortality and morbidity in the neonatal period. The incidence of RDS increases with decreasing gestational age. Especially, in extremely preterm infants, the babies born before < 28 th weeks gestational age, the risk is the highest for RDS with an incidence of 93%. Optimal timing of delivery is a critical determinant of perinatal outcome. When faced with a pregnancy complication and the possibility of an iatrogenic preterm birth, knowledge of the lung maturity status of the fetus will assist the obstetric care provider in deciding about the optimal delivery timing.

Schenone et al., **[6]** have reported that main pulmonary artery At/Et ratio and the TDx-FLM-II (measured in the amniotic fluid) were positively correlated, which means that an increased At/Et ratio is associated with a more mature lung and a less risk of developing RDS, which supports our findings. They stated that possible explanations for these findings, based on other studies, include the following: (1) Measurement of the At/Et ratio is a noninvasive way to assess impedance to flow and pulmonary pressure as described by Kitabatake et al., **[7]** that study was on patients with normal

pulmonary artery pressure, the ejection flow reached a peak during mid-systole; in contrast, in patients with pulmonary hypertension the ejection flow peaked sooner (shorter acceleration time), which translates into lower At/Et ratio values in the setting of a high impedance to flow, and vice versa. (2) As described by Rasanen et al., **[8]**, the pulmonary arterial impedance decreases as the gestational age (GA) advances, and it was hypothesized that this could result from continued pulmonary angiogenesis, a larger vascular lumen, increased vessel wall elasticity, and/or an increasing concentration of surfactant during the late third trimester, all of which are related to lung maturation **[9]**.

On the contrary, Azpurua et al., **[10]** have reported that At/Et ratio was inversely correlated with L/S ratio obtained by amniocentesis. Their study, however, could not correlate At/Et ratio with the development of clinical RDS as their study sample size (29 fetuses) was low with only one infant diagnosed with RDS.

Guan et al., **[11]** investigated the effect of increasing gestational age on the Doppler wave form in the main pulmonary artery. Of the eight Doppler variables analyzed, five increased significantly with increasing gestational age (most dramatically acceleration time (At) and At/Et ratio, but also peak systolic volume (PSV), end diastolic volume (EDV), and main volume (MV); pulsatile index (PI) decreased with increasing gestational age, and Eejection time (Et) and resistance index (RI) did not change significantly throughout gestation. This was inconsequent with Chaoui et al., **[12]** who demonstrated that longitudinal measurements of the main pulmonary artery branches with Doppler velocimetry in 86 singleton fetuses, showed increased perfusion and decreased vascular resistance and pressure from 18-38 weeks' gestation. Suggesting that this is due to a lengthening of the acceleration time (At) interval over the same period and to a progressive decrease in pulmonary vascular resistance and increase in pulmonary blood flow with advancing GA **[8]**.

But none of the mentioned studies defined cutoff values of pulmonary indices for prediction of lung maturity and did not examine the association with the clinical end point of interest, namely respiratory distress syndrome.

Our study has shown that main pulmonary artery (At/Et ratio), fetal lung to liver echogenicity, free particles in amniotic fluid and placental grading were positively correlated with lung maturity. It identified main pulmonary artery At/Et ratio (cutoff $\geq$ 0.30) with (92.5% sensitivity, 87.2% specificity), as reliable predictors of neonatal RDS. This means that fetuses that develop RDS have higher pulmonary vascular resistance, pressure, lower pulmonary blood flow, lower lung echogenicity compared with fetuses that do not develop RDS. Furthermore, combination of these measures has greater sensitivity & negative predictive value than when either measure was used alone. Therefore, these measurements might be alternatives to invasive procedures for assessment of fetal lung maturity before delivery.

In our study we resorted to parameters that were not significantly affected by the angle of insonation; such as, main pulmonary artery At/Et, PI and RI. There was a significant correlation between the At/Et and the development of the RDS as the At/Et was significantly lower in the RDS +ve group (mean 0.23) in comparison to the RDS –ve group (mean 0.3), (p-value 0.001). While both RI and PI showed no statistically significant difference in between the two groups, p-values 0.336 and 0.271 respectively. An At/Et cut of point of 0.3 predicted the development of neonatal RDS with a high sensitivity, specificity, negative predictive value and accuracy (92.3%, 82.4%, 93.3% and 89.8% respectively).

Our results were in agreement with Abdelhamid et al., **[1]**; Jose et al., **[13]**; Mohamed et al., **[14]**; Osama et al., **[15]**; Aboulghar et al., **[16]** and Büke et al., **[17]**. All of them had similar study designs (comparing the fetal main pulmonary artery Doppler with Clinical outcome). Who compared the At/Et to albumin/surfactant ratio. This significant positive correlation between the At/Et ratio and fetal lung maturity may be explained as the elevated At/Et ratio represents a decrease in fetal pulmonary arterial pressure which is expected in a mature fetal lung **[12]**.

However, our results contradicted with Kim et al., **[18]** and Mohamed et al., **[14]** who found that Pulmonary artery At/Et ratio was inversely correlated to fetal lung maturity. The discordance may be due to a variation in study population or details of the ultrasound measurements and equipment. In this studies the researcher was not able to spend much time at the delivery ward every day due to other duties, as radiology resident, in parallel. To be able to make good timings of ultrasound image acquisitions in relation to delivery, it has become evident during this study that it is of great importance that the researcher can indeed spend a lot of time at the delivery wards, being well informed

by the physicians concerning the possible candidate's health and delivery status.

Our study showed that gestational age, free particles of amniotic fluid, fetal lung to liver echogenicity and placental grading were significantly correlated with development of neonatal respiratory distress syndrome as gestational age was lower on those who eventually developed neonatal RDS (*p*-value <0.001). This is in agreement with the previous reports, making gestational age and hence prematurity the most important factor in neonatal RDS development.

All RDS +ve neonates were admitted to NICU (100%), while only 3 cases in the RDS –ve group were admitted to NICU. This is expected as all who developed RDS were assumed to be admitted to NICU. One of the values of using these noninvasive techniques is guiding the clinical decisions concerning delivery planning and administering antenatal steroids. The clinician has to balance the benefits of a preterm birth on both mother and child against the obvious risks of preterm births for the neonate. Another theoretical possible way of using a high risk result would be to use as an indication for antenatal steroids, to enhance fetal lung maturity and to estimate the deleterious effects of the antenatal steroids given. It is obvious from the results of our study that both fetal lung maturity and fetal pulmonary artery At/Et ratio are comparable in predicting fetal lung maturity and hence development of neonatal RDS.

Consequently, adding the measurement of main pulmonary artery Doppler indices, to routine 2D ultrasonography of fetal biometry especially in case of preterm delivery would be convenient to predict fetal lung maturity before a preterm birth noninvasively, to allow therapeutic protection against possible RDS in the neonate, estimate the effect of steroid treatment of a preterm fetus by repeated tests, could help to reduce unnecessarily early cesarean deliveries, or giving an idea about the fetal lung maturity status, for better preparation & counseling (i.e. checking availability of NICU or starting corticosteroids) in such low-resource conditions. This approach might also lower both the incidence of neonatal RDS and the need for admission to the NICU, which in turn could reduce rates of morbidity and mortality among newborns.

Conclusions:

In conclusion, and based on our results, we found that main pulmonary artery (MPA) At/Et ratio, together with fetal lung to liver echogenicity, free particles in amniotic fluid and placental grading can be used as non-invasive accurate methods for prediction of neonatal respiratory distress syndrome (RDS) and fetal lung maturity (FLM), with even higher sensitivity and predictive values when incombined. Main pulmonary artery At/Et showed significant difference between fetuses developing RDS and those who did not, but it's recommended to be combined to the other measurements, as alone it shows lower specificity along the different gestational age (GA).

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دور دوبلر الشريان الرئوى للجنين فى التنبؤ بنضج الرئتين

الخلفية: يعتبر نضج الجهاز الرئوى هو آخر مطلب للجنين حتى يمكن الحياة خارج الرحم، ولا تزال متلازمة الضائقة التنفسية من أهم الأمراض التى تشكل خطراً على حياة الطفل حديث الولادة.

الهدف من الدراسة: التأكيد على دور دوبلر الشريان الرئوى للجنين فى التنبؤ بنضج رئة الجنين من خلال مقارنة نتائج دوبلر الشريان الرئوى الرئيسى للجنين مع عمر الحمل والنتائج الوليدية.

المرضى والطرق: أجريت هذه الدراسة المقطعية العرضية الرصدية فى مستشفى النساء والتوليد وأمراض النساء بجامعة عين شمس بعد موافقة لجنة أخلاقيات البحث بالمستشفى لمدة ٨ أشهر. أشتملت الدراسة على ستين أمرأة حامل تتراوح أعمارهن بين ١٨–١٤ سنة بين ٢٨ إلى ٤٠ أسبوعاً من عمر الحمل، وقد تم قبولهن لعملية قيصرية اختيارية، أو حضرن إلى وحدة الولادة إما فى المخاض النشط أو لإجراء عملية قيصرية انتقائية. تم إجراء فحوصات الموجات فوق الصوتية فى غضون ٤٨ ساعة للنساء الحوامل من ٢٨ أسبوعاً إلى ٤٠ أسبوعاً.

النتائج: النسبة بين وقت التسارع ووقت الطرد للشريان الرئوى الرئيسى للجنين، الجسيمات الحرة فى السائل الأمنيوسى ودرجات المشيمة كانت مرتبطة بشكل إيجابى بنضج الرئة. حددت النسبة بين وقت التسارع ووقت الطرد للشريان الرئوى الرئيسى للجنين (عند نقطة فصل ٣.٠) مع (حساسية ٥.٩٢٪، وخصوصية ٢.٨٧٪)، كمتنبئ موثوق فيه للضائقة التنفسية الوليدية. وأظهرت دراستنا أيضاً أن عمر الحمل والجسيمات الحرة فى السائل الأمنيوسى وصدى رئة الجنين إلى صدى الكبد مع الدرجات المشيمية كانت مرتبطة ارتباطاً وثيقاً بتطور متلازمة الضائقة التنفسية الوليدية حيث كان عمر الحمل أقل لدى أولئك الذين تعرضوا للضائقة التنفسية الو ليدية (عند نقطة دلالة إحصائية <٠.٠٥). علاوة على ذلك، فإن الجمع بين هذه المقاييس له حساسية أكبر وقيمة تنبؤية سلبية أكبر مما كانت عليه عند استخدام أى من المقاييس بمفرده. لذلك، قد تكون هذه القياسات بدائل للإجراءات التداخلية لتقييم نضج رئة الجنين قبل الولادة.

الخلاصة: النسبة بين وقت التسارع ووقت الطرد للشريان الرئوى الرئيسى للجنين، جنباً إلى جنب مع صدى رئة الجنين إلى صدى الكبد، مع الجسيمات الحرة فى السائل الأمنيوسى وتضنيف المشيمة يمكن استخدامهم كطرق دقيقة غير تداخلية للتنبؤ بمتلازمة الضائقة التنفسية الوليدية ونضج رئة الجنين، مع حساسية أعلى وقيم تنبؤية أعلى عند الدمج. وأظهرت النسبة بين وقت التسارع ووقت الطرد للشريان الرئوى الرئيسى للجنين فرقاً كبيراً بين الأجنة الذين أصيبوا بالضائقة التنفسية وأولئك الذين لم يتعرضوا لذلك، ولكن يوصى بدمجها مع القياسات الأخرى، حيث إنه يُظهر وحده خصوصية أقل مع عمر الحمل.