A study of fetal lung maturity correlated by various USG parameters at a primary health care centre

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Abstract
Background: Fetal lung maturity is the key factor for the survival of prematurely delivered newborn baby. Ultrasonography is considered the gold standard to know the fetal lung maturity. Certain ultrasonographic parameters like placental grading, bi-parietal diameter, lower limb epiphyseal centers and free floating particles in amniotic fluid can be used as predictor of fetal lung maturity. **Aim:** To assess the fetal lung maturity with the help of USG parameters at primary health care centre. **Material and Methods:** Seventy-two patients who were in pre-labor may be at term or preterm were scanned in the Department of Radiology for fetal lung maturity. The findings were correlated with placental grading,bi-parietal diameter, lower limb epiphyseal centers and free floating particles in amniotic fluid. **Results:** With gestational age ≥37 weeks, there is variation in placental grading but majority of patients showed grade III placenta. Nearly all patients with free floating particles have distal femoral epiphysis≥5 mm and proximal tibial epiphysis≥5 mm and almost all patients with biparietal diameter ≥9.0 cm showed mature lower limb epiphyseal centres. **Conclusion:** USG is anoninvasive, reliable and cost effective technique to reduce mortality and morbidity in neonates. When we use USG parameters to assess fetal lung maturity the priority should be given to BPD ≥9.0 cm (100%), DFE ≥5 mm (98%), PTE ≥5 mm (97.7%), grade III placenta (96.9%) and free floating particles (95.1%).
Key Words: Fetal lung maturity, ultrasonography, placenta grading, biparietal diameter, lower limb epiphysiscentres

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	Accessed Date: 28 February 2018

INTRODUCTION

Respiratory distress syndrome (RDS) is a major cause of neonatal mortality and morbidity where the lung cannot provide sufficient oxygen.[1]Prediction of lung maturity is important in the management of high-risk pregnancies.[2] There are various methods of determination of fetal lung maturity, such as, clinical methods like menstrual history and Last menstrual period (LMP), per abdomen examination and date of quickening.[3]In our country, health education is poor. Majority of females are quite careless about their menstrual history. So, we cannot determine the exact gestational age to assess the maturity clinically. Per abdominal examinations can also give erroneous results in cases such as polyhydrominos or multiple gestation or IUGR. So, to avoid the drawbacks of clinical methods, additional help of ancillary methods like amniocentesis, radiography and ultrasonography is required to assess the fetal maturity.[4,5] Amniocentesis is an invasive technique and use of X-rays is hazardous to fetus. Fetal lung maturity can assess indirectly by ultrasonographic marker of fetal lung maturity. Certain ultrasonographic parameters like placental grading, bi-parietal diameter, lower limb epiphyseal centers and free floating particles in amniotic fluid can be used as predictor of fetal lung maturity. The present study was conducted to assess the fetal lung maturity with the help of USG parameters at primary health care centre.

MATERIAL AND METHODS

In this randomized study, a total of 72 patients who were in pre-labor may be at term or preterm were scanned in the Department of Radiology for fetal lung maturity.

Technique: The ultrasound scanning was performed with ALOKA SSD-630 real time B mode ultrasound unit with 3.5 MHz convex transducer. Aquasonic jelly was applied all over the abdomen to make good contact between transducer and the skin. The obstetric ultrasound was performed to know the following points:

- Biparietal diameter: The measurements were taken with calipers. The skull was measured from outer table to inner table and the largest diameter was used where a clear mid-line echo of thalamus was evident along with septum pellucidum.
- Placenta: The placenta is scanned thoroughly and classified on the basis of Grannum's classification.
- Epiphyseal centres: The fetal knee was scanned and the size of distal femoral epiphysis and proximal tibial epiphysis were measured.
- Free floating particles: Largest pocket of amniotic fluid was scanned and observed for linear densities of size 1-5 mm which were suspended but gradually settled in amniotic fluid.

RESULTS

With gestational age ≥37 weeks, there is variation in placental grading but majority of patients showed grade III placenta.

Table 1: Distribution of placental grades by gestation

Gestational age	No. of cases	Placental grades			
		0	I	II	III
<37 weeks	37	01	18	06	12
≥37 weeks	35	00	04	10	21

Maximum patients with free floating particles have grade III placenta.

Table 2: Correlation between free floating particles and placental grades

Free floating particles	No. of cases	Placental grades			
		0	I	II	III
Present	41	00	02	08	31
Absent	31	01	20	08	02

Maximum patients with free floating particles have BPD≥9.0 cm.

Table 3: Correlation between free floating particles and BPD

Free floating particles	No. of cases	BPD	
		<9 cm	≥9 cm
Present	41	14	27
Absent	31	29	02

Table 4: Correlation between free floating particles and epiphyseal centres of lower limb

Free floating particles	No. of cases	Distal femoral epiphysis		Proximal tibial epiphysis	
		<5 mm	≥5 mm	<5 mm	≥5 mm
Present	41	01	40	04	37
Absent	31	21	10	23	08

Nearly all patients with free floating particles haveDFE ≥5 mm and PTE ≥5 mm.

Table 5: Correlation between biparietal diameter and epiphyseal centres of lower limb

Biparietal diameter	No. of cases	Distal femoral epiphysis		Proximal tibial epiphysis	
		<5 mm	≥5 mm	<5 mm	≥5 mm
<9.0 cm	43	20	23	24	19
≥9.0 cm	29	02	27	03	26

Nearly all patients with biparietal diameter ≥9.0 cm showed mature lower limb epiphyseal centres.

DISCUSSION

Until now, it has been possible to determine fetal lung maturity only by amniocentesis. Since the functional changes of the fetal lung leading to maturity are also morphologically apparent, fetal lung maturity can be demonstrated sonographically. Placenta is a fetal organ. Fischer CC described the characteristic ultrasonic pattern of maturing placenta.[6] Grannum and associates described the grades of placenta as grade 0 to III.[7] This study included 72 patients only one patient showed grade 0 placenta but show negative shake test, suggesting that grade 0 predicts fetal lung maturity in 0% cases. 15 patients out of 22 with grade I placenta show positive shake test. 14 patients out of 16 with grade II placenta have positive shake test and nearly all patients except one with grade III placenta show positive shake test. Thus, the predictivity of fetal lung maturity on the basis of placenta grades is as follows: Grade 0 - 0%, Grade I - 68.1%, Grade II - 87.5% and Grade III -96.9%. In the study by Grannum, the fetal maturity predicted by placenta grades as compared to L/S ratio was 100% in grade III placenta.[7]Petrucha in his study show 100% correlation between grade III placenta and fetal lung maturity.[8]Tabsh in his study found that 92% of patients with grade III placenta have mature L/S ratio.[9]Hill in his study on 72 patients suggest 92% correlation between grade III placenta and mature L/S ratio.[10] He also suggested that all the grade III placentas were associated with an absence of neonatal respiratory disease. Thus our study correlates with studies of Grannum, Petrucha, Tabsh and Hill.[7-10] In this study on 72 patients, 50 patients showed distal femoral epiphysis ≥5 mm. Out of these 50 patients, only one showed negative shake test i.e., 98% of these patients

with distal femoral epiphysis ≥5 mm and suggest fetal lung maturity. While 45 patients showed proximal tibial epiphysis ≥5 mm. Out of these 45 patients, show positive shake test i.e., 97.77%. Tabsh evaluated 133 patients for lower limb epiphyseal centre to determine fetal lung maturity and found 100% and 95% correlation between PTE ≥5 mm and DFE ≥5 mm with lung maturity respectively.[9] Mahony in his study of 116 cases concluded 100% maturity of fetal lung when DFE + PTE ≥11 mm.[11] Our study and other above mentioned studies show correlation. In the study of 72 patients with BPD >9.0 cm as criteria for fetal lung maturity. 29 out of 72 patients show BPD 9.0 cm. All the patients (29) with BPD >9.0 cm show positive shake test. Out of the remaining 43 patients with BPD <9.0 cm only 32 patients i.e., 74.41% patients show positive shake test. This suggests 100% correlation between BPD >9.0 cm and fetal lung maturity which also corresponds with following studies. Lee et al reported positive prediction of absence of respiratory distress syndrome when BPD >8.7 cm.[12] Hayashi concluded that BPD >9.2 cm in nondiabetic patient was present in all fetuses whose L/S ratio were mature.[13] In the study of Petrucha the results suggest that ultrasonically determined BPD >9.2 cm and grade III placenta were at least as sensitive as the L/S ratio >2 in predicting fetal pulmonary maturity.[8] Hadlock in his study concluded that after 37 weeks only 9.5% of patients have false positive prediction of fetal lung maturity.[14] In the study of Gross, BPD >9.0 cm was associated with 97% of term delivery.[15] This study concluded that ultrasonography marker of fetal lung maturity is a noninvasive, reliable and cost effective technique to reduce mortality and morbidity in neonates. When we use USG parameters to assess fetal lung maturity the priority should be given to BPD ≥9.0 cm (100%), DFE ≥5 mm (98%), PTE ≥5 mm (97.7%), grade III placenta (96.9%) and free floating particles (95.1%).

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Source of Support: None Declared
Conflict of Interest: None Declared