شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم

MONA MAGHRABY

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جامعة عين شمس

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قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

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Role of 3D Ultrasound for Assessment of Fetal Lungs

Thesis

Submitted for Partial Fulfillment of Master Degree in Diagnostic Radiology

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إهداء

إلى من علماني أبجديه الوجود ..

أبي وأمي.....

وإلى أخي محمد ...

من علمني أبجدية البحث عن الحقيقه رغم صغر سنه

فلهم جميعاً مني جزيل الشكر ،،

الباحثة

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List of Abbreviations

2D US	Two dimentional ultrasound
3 HeMRI	3 Helium Magnetic Resonance Imaging
3D US	Three dimentional ultrasound
ACD	Alveolar capillary dysplasia
AFI	Amniotic fluid index
AT	Acceleration time
BADJ	Bronchio-alveolar duct junction
BMP-4	Bone morphogenic protein 4
BPD	Broncho-pulmonary dysplasia
eNOS	Endothelial nitric oxide synthase
ET	Ejection time
FGF-10	Fibroblast growth factor 10
FLM	Fetal lung maturity
FLV	Fetal lung volume
GA	Gestational age
HD	High definition
ICU	Intensive care unit
KANET	Kurjak antenatal neurodevelopmental test
RDS	Respiratory distress syndrome
ROC	Receiver operating curve
SD	Standard deviation
SHH	Sonic hedgehog
SPSS	Statistical package for social science
VEGF	Vascular endothelial growth factor
XI VOCAL	Extended imaging virtual organ computer aided analysis

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Introduction

The maturation of fetal pulmonary system is a complex process entailing cellular, physiological, and biological interactions that usually occurs late in gestation being one of the last maturing fetal systems ***(Senthilkumar and Ezhilarasi, 2015).***

Therefore, respiratory distress is commonly encountered among premature babies immediately after birth resulting in significant neonatal morbidity or mortality. It has been established to correlate with structural and functional lung immaturity. It is described as respiratory distress in infants that sets in within a few hours of parturition. The incidence of RDS is inversely proportional to gestational length and has been estimated to range from 30% below gestational week 28 to 5% in neonates born in a gestational week above 34 ***(Hermansen and Lorah, 2007).***

Three types of tests are traditionally used to assess the degree of fetal lung maturity (FLM) namely; the biochemical testing for surfactant components (e.g. Lecithin/ sphingomyelin ratio), biophysical testing for surfactant functionality (e.g. Foam stability index) or physical testing of the amniotic fluid opacity (e.g.lamellar body counts) ***(Varner et al., 2013).***

All these tests involve the use of amniotic fluid (as it communicates directly with lung fluid), therefore, invasively and indirectly evaluate the probability of lung maturity. Moreover, they predict lung maturity more accurately than immaturity. Tests that directly assess fetal lung function are yet not available ***(Maged et al., 2017).***

Ultrasound cannot measure biochemical changes in the growing lung or histological changes but it is reasonable to assume that both morphological and biochemical changes alter the propagation properties in the fetal lung .The possibilities of using ultrasound as a non-invasive method for assessment of fetal lung maturity have been greatly explored over the last 30 years ***(Palacio et al., 2012).***

Three-dimensional sonographic measurements are shown to be helpful in assessing the fetal lung volume .Fetal lung volumetry with 3D sonography can be regarded as agood alternative to MRI ***(Kehl et al., 2011).***

Aim of the Work

The purpose of this study is to correlate lung parameters using three dimensional ultrasound (3D US) with lung maturity assessed by postnatal outcome , and to develop reference cutoff value for these parameters (mean FLV) as measure that could be used to predict the development of neonatal RDS.

Fetal lung development

Human lung development is divided into different morphological stages that correspond to key developmental transitions: (1) embryonic, (2) pseudoglandular, (3) canalicular, (4) saccular and (5) alveolar ***(Rackley and Stripp, 2012).***

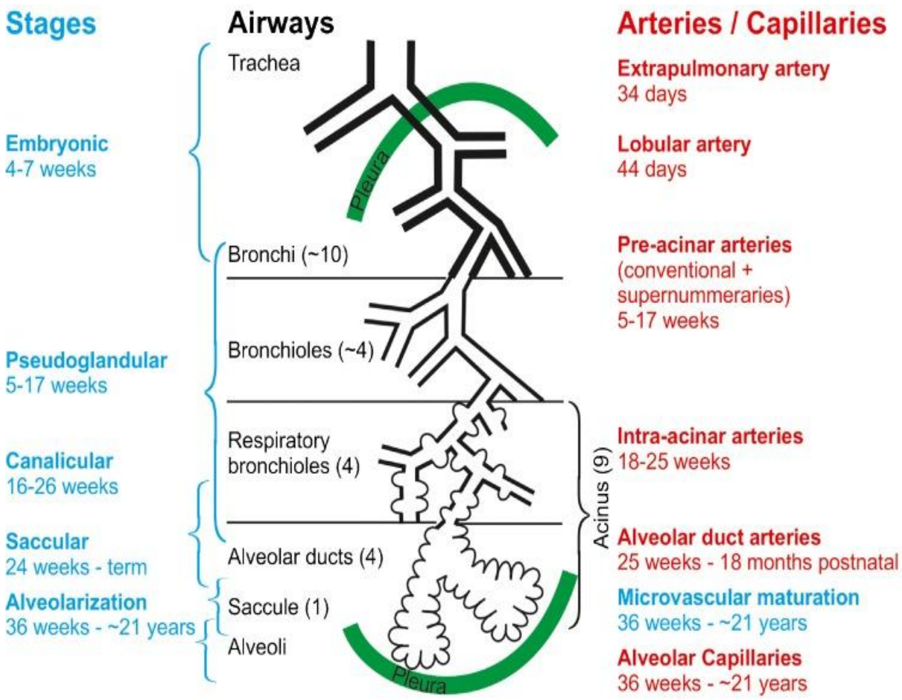

Figure (1): Development of the airways and arteries. The stages of lung development (*blue*) are correlated to the development of the airways (*black*) and the arteries (*red*) ***(Schittny, 2014).***

Embryonic period/organogenesis (weeks 4–7)

- ***Anlage of the lung and trachea***

In humans at day 26 p.c., the anlage of the right and left lungs appears as two independent outpouchings of the ventral wall of the primitive foregut, two lung buds ***(Cardoso and Lu 2006).*** They are not the result of the first branching of a common lung bud as postulated earlier (Fig. 2a). Both lung buds begin elongating and start a repetitive circle of growth into the surrounding mesenchyme and branching (branching morphogenesis; Fig. 2b–d). The primitive foregut divides into the esophagus and trachea after a deepening and joining of the laryngotracheal sulci of the lateral walls of the foregut. Mesenchymal cells surrounding the forming trachea are condensing focally and differentiate into precursors of cartilage towards the end of the embryonic period. With further development of the bronchial tree, the formation of the cartilage moves distally until it reaches the smallest bronchi (25 weeks) ***(Sadler 2014).***