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Research Article

CYTOARCHITECTURE OF HUMAN FETAL LUNG

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ABSTRACT
In humans, the lung develops during prenatal life and infancy, after which it increases in size but not complexity. Airways are prominent and are lined by pseudo stratified columnar epithelium by 10wks of gestation and precursors of chondrocytes are observed in the principal bronchus. Segmentation of the lung by tertiary bronchi is distinct by 14 wks gestation. Respiratory bronchioles and alveolar sacs are formed by 24 wks of gestation. Some of the alveoli are lined by cuboidal and squamous epithelium at 30 wks of gestation. By 36 wks of gestation all the alveoli are lined by squamous epithelium. The present study in human destitute fetuses has been taken up to observe changes in the cytoarchitecture of human foetal lungs during their development.

***Key Words**: Alveoli, Bronchi, Cartilage, Cuboidal, Lung*

INTRODUCTION
In humans, the lung develops during prenatal life and infancy, after which it increases in size but not complexity. Exposure to sub-optimal environmental conditions during these early life stages can alter lung development, leading to reduced lung function and an increased risk of respiratory illness later in life. The fetal lung is maintained in an expanded state by the presence of liquid within the future airways (Hooper SB 1995). This liquid is secreted across the pulmonary epithelium into the lung lumen and leaves the lungs via the trachea. Thus, obstructing the fetal trachea causes liquid to accumulate within the future airways, causing the lungs to expand, which is a potent stimulus for fetal lung growth and development. So the present study in human destitute fetuses has been taken up to observe changes in the cytoarchitecture of human foetal lungs during their development.

MATERIALS AND METHODS

Destitute fetuses were obtained from general hospital MIMS, and local government and private hospitals, after getting necessary permissions from the concerned heads of the hospitals. These foetuses were well preserved and CR length measurements were noted and the gestational ages were computed (Hamilton *et al.,* 1971). The thoracic cage dissected to expose the foetal lungs. The lungs were procured and were processed for histological examination with hematoxylin and eosin (Culling 1974).

RESULTS
At 10 wks of gestation Lung showed a number of airways and vasculature (fig.1). Airways were prominent with ciliated pseudostratified columnar epithelium (fig.2). The division of lung into upper small lobe and a lower large lobe was distinct during 10 wks of gestation(fig.3). In the deeper sections that is after about 250 microns, the principal bronchus showed the division into three secondary bronchi in right lung (fig.4). Primary air ways are very clear with number of mesodermal cells surrounding the air tube. Cartilage is not visible during this gestation.

At 14 wks gestation, the lung is seen segmented by tertiary bronchi under 4x 10 magnification (fig.5). Hyaline cartilaginous plates are very prominent in the bronchus and is lined by ciliated pseudostratified columnar epithelium(fig.6). Entire stoma of the lung are filled by tertiary bronchioles. The bronchioles are lined by cuboidal epithelium with smooth muscle enveloping them (fig.7).

At 24 wks of gestation a numbers of respiratory bronchioles are formed and is highly vascular. Atrium opening into alveolar sac is prominent. Alveolar sacs are lined by cuboidal epithelium and squamous cell lining, which shows that the lung is in a stage of differentiation (fig.8). The alveoli are many in number, proliferating, compact and are lined by squamous and cuboid cells at 30wks gestation having similar appearance to that of 24 wks gestation.

All the alveoli are well developed and are lined by squamous cells by 36wks gestation. Vascularisation is very distinct surrounding the alveoli which is helpful in diffusion of air (fig.9).

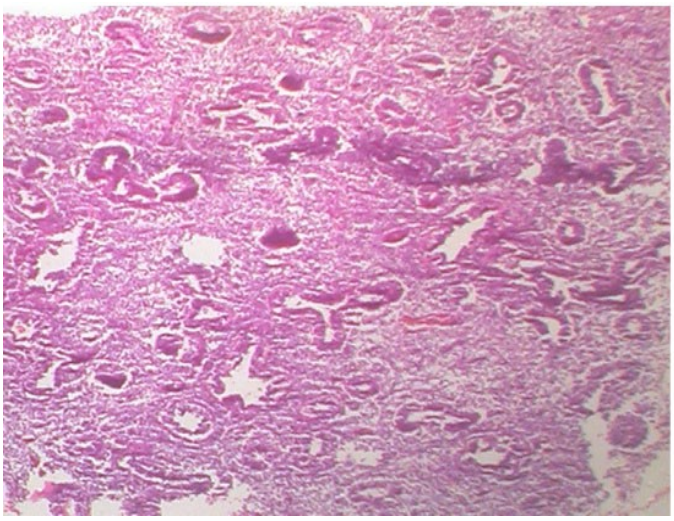

Figure 1: Lung showing airways and vasculature at 10 wks gestation, H&E, 4x10

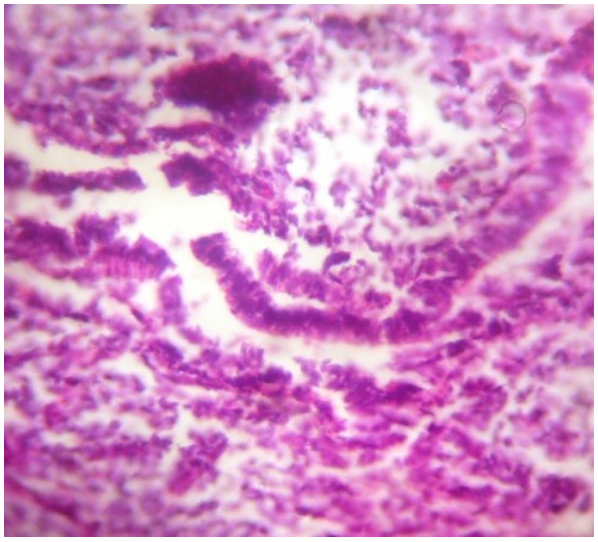

Figure 2: Bronchus with ciliated pseudostratified columnar epithelium at 10 wks gestation, H&E, 40x10

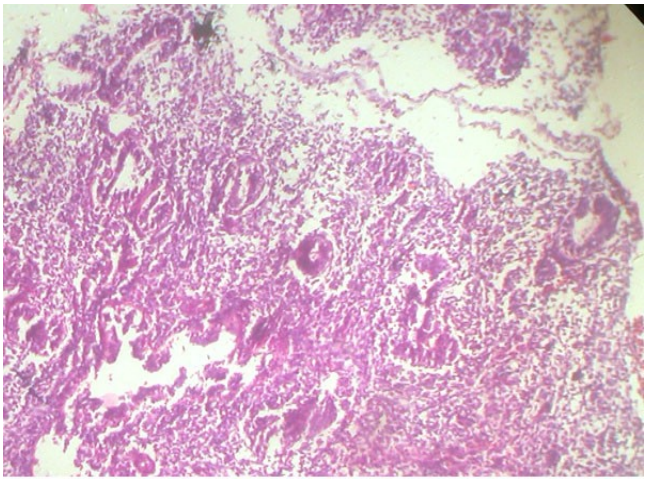

Figure 3: Upper and lower lobes of lung, H&E, 10x10

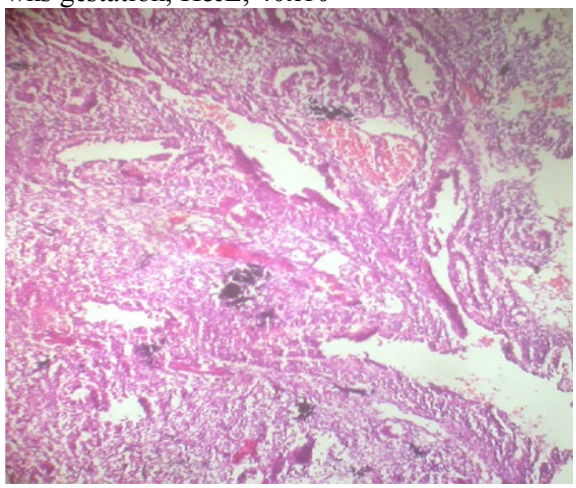

Figure 4: Division of principal bronchus into three secondary bronchi, H&E, 10x10

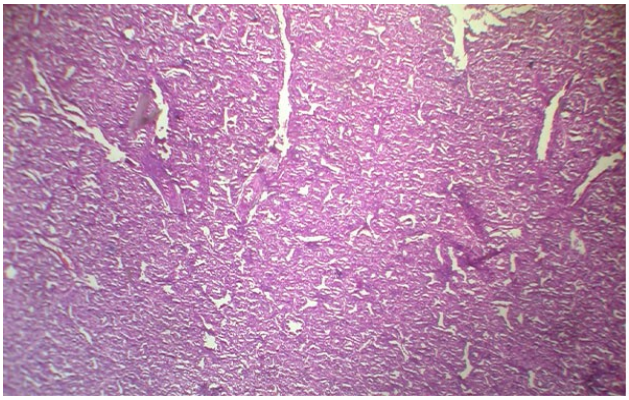

Figure 5: Panoramic view of lung at 14 wks gestation, H&E, 4x10

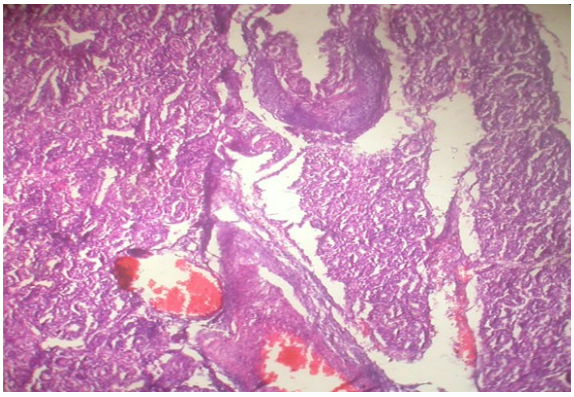

Figure 6: Hyaline cartilaginous plates at 14 wks gestation, H&E, 10x10

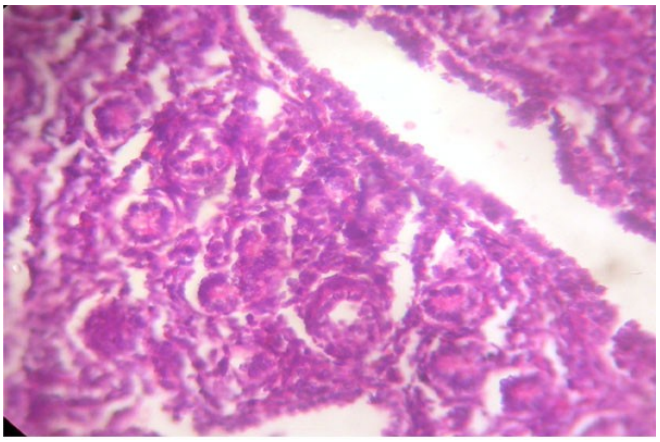

Figure 7: Tertiary bronchioles at 14 wks gestation, H&E, 40x10

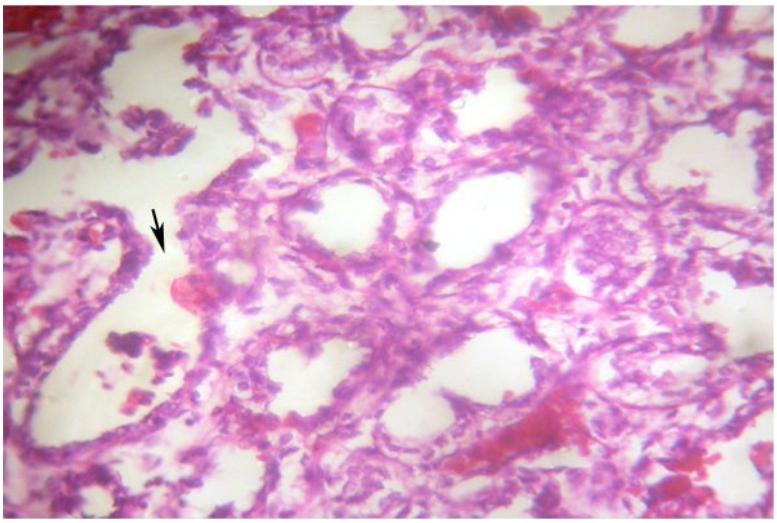

Figure 8: Opening of atrium into alveolar sac at 24 wks gestation, H&E, 40x10

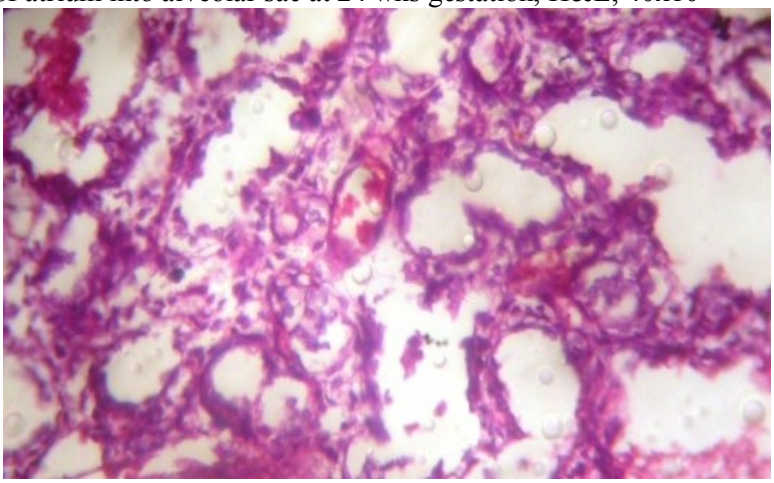

Figure 9: Showing well developed alveoli which are lined by squamous cells by 36wks gestation, H&E, 40x10

DISCUSSION

In the human fetus, periodic respiratory activity can be detected by ultrasound from the 11th week of gestation, and this becomes more marked as pregnancy progresses(Boddy *et al.,* 1975) This fetal breathing (FB), regulates release of tracheal fluid in the lung and consequently regulates alveolar expansion, and seems to favor lung development(Harding *et al.,* 1986).

The canalicular stage of fetal lung development starts at the 16th week of gestation and lasts until the 24th week. The saccular stage starts at the 24th week and lasts until the fetus comes to term. Airway development begins to spread out and form airspaces, or saccules, within the chambers .The saccular stage of the lung is seen during 24 wks of gestation which is in agreement with that of the above quote.

The lumina of the bronchi and bronchioles became much larger and the lung tissue became highly vascular in 17to 24 weeks (Cui Yunhe *et al.,* 1998**).** In the present study also, vasularisation is very much distinct during 24 wks of gestation. Lack of respiratory movements in the fetus could therefore result in impaired development of the alveoli and in pulmonary hypoplasia (Barness 1997)

In the fetal lungs, the presence of Bronchus-associated lymphoid tissue (BALT) is almost invariably associated with chorioamnionitis or intrauterine pneumonia., BALT may be present in the human fetal

and infant lung, but its appearance is probably dependent on antigenic stimulation (Gould and Isaacson, 2005)

Conclusion

Lung development during the prenatal stages is an important process that is highly influenced by toxic agents. Tobacco smoke is one such agent that impedes the development of fetal lung growth. Lung development may be impaired by maternal tobacco smoking, low intrathoracic space, and respiratory infections. The use of steroid medications can also hamper lung development in the fetus. Steroids also target epithelial cell layer growth. One other factor that greatly affects lung development in the fetus is the nutritional intake provided by the mother to the fetus.

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