

Research Article

Development and histogenesis of human foetal lung in relation with gestational age

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ABSTRACT

Background: The objective was to study the development and histogenesis of human foetal lung in relation with different gestational age.

Methods: In the present study lung specimens were collected from formalin fixed 27 aborted fetuses (14 male, 13 female) by abdominal dissection between 6 weeks to 40 weeks of gestational age.

Results: In the present study we observed that there was a delay in the appearance of embryonic, pseudo glandular phase, canalicular, terminal saccular and alveolar stages of the lung.

Conclusion: Delay in the developmental anatomy and histogenesis of the lung cells leads to histopathological abnormalities which gives knowledge to the clinicians during clinical procedures.

Keywords: Embryonic, Pseudo glandular phase, Canalicular, Terminal saccular and alveolar stages

INTRODUCTION

Lungs are major respiratory organs in the human body (Peter Williams, 1993¹) and they appear to be the lost among the large organs of human body about which a complete unquestioned embryological story has been built. They develop as a diverticulum of the foregut during 3-4 weeks of gestational age (Keith L. Moore & Persaud, 1999²). Lungs have a dual origin like Kidney, According to this larynx, trachea bronchi, bronchioles and part of respiratory bronchioles lined with cuboidal epithelium arises from foregut diverticulum and remaining respiratory bronchioles, alveolar ducts, alveolar sacs and alveoli arise from adjacent mesenchyme (Rose, 1995³). Congenital lung diseases most often from acquired developmental defects arising during gestation. Agenesis, accessory lung, ectopic lung, persistence of foetal lobulation, congenital lung cysts are some of the common developmental abnormalities.

METHODS

A total of 27 formalin preserved dead embryos and fetuses with relevant obstetric records available in the department of anatomy, B.M.C. Chitradurga were utilized for this study. The fetuses from 6 weeks to 40 weeks of gestational age of both the sex. Foetuses were preserved by injecting 10% formalin solution into the pleural, peritoneal and the cranial cavities. Their extremities were preserved by multiple injecting techniques described by (Ajmani, 1996⁴).

By dissection method we collected the lung specimens from the thoracic cavity. All the specimens were categorized in to four groups based on gestational age. The specimens were preserved in 10% formalin subjected to routine tissue procedure, stained with haematoxylin & eosin, Verhoff's stains.

RESULTS

In the present study a total of 27 aborted embryos and fetuses of different gestational ages of both sexes and normal abnormal were observed (Table 1). The prenatal specimens are categorized in to gestational age groups of 0-12 weeks, 12-24 weeks, 24-36 weeks and more than 36 weeks. One representative sample of lung tissue from each gestational age group was processed for routine histological examination.

Table 1: Prenatal lungs - distribution of specimens.

No. of foetus	Male (14)	Female (13)	Total (27)
Gestational age (weeks)	Lung specimens	Lung specimens	Total (54)
0-12	4	4	6
12-24	8	8	16
24-36	12	10	20
>36	4	4	12
Total	28	26	54



Figure 1: Serial section of 6-8 weeks showing embryonic phase primordium of lung buds (LL: left lung, RL: right lung) with segmental bronchi (SB) and trachea (T) magnification, 4 x 10x.

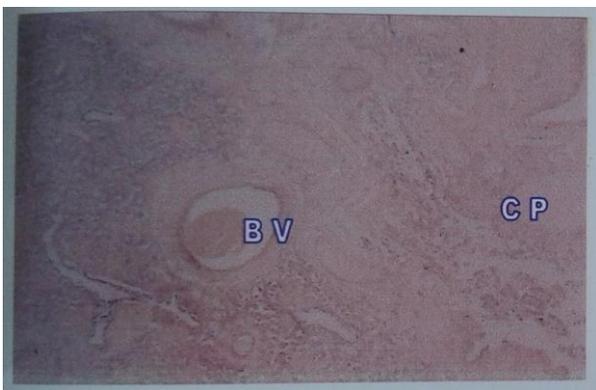


Figure 2: Histological sections of 16 weeks showing canalicular phase blood vessels (BV), cartilaginous plate (CP), magnification 10 x 10x.

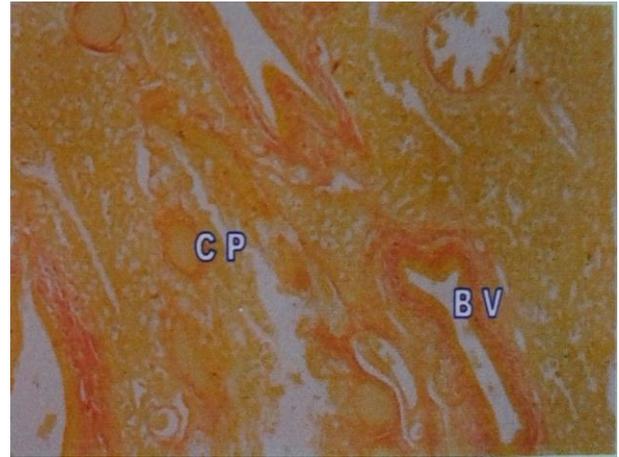


Figure 3: Histological sections of 16 weeks showing canalicular phase blood vessels (BV), cartilaginous plate (CP), magnification 10 x 10x.



Figure 4: Histological sections of 30 weeks showing terminal phase cartilagenous bronchus (CB), magnification 10 x 10x.

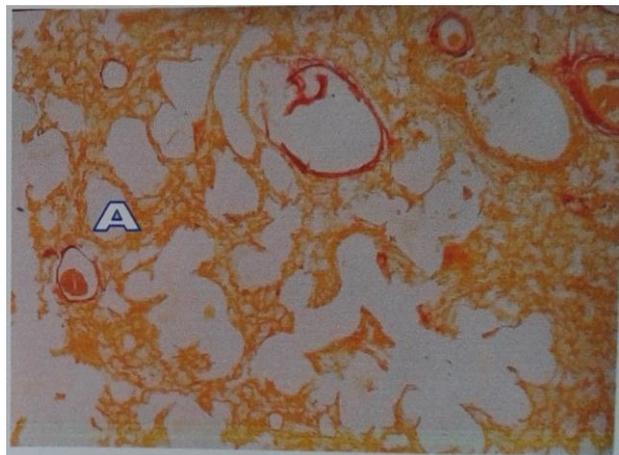


Figure 5: Histological sections of 40 weeks showing alveolar phase cartilagenous bronchi (CB), alveolar ducts (A) and blood vessels (BV), magnification 10 x 10x.

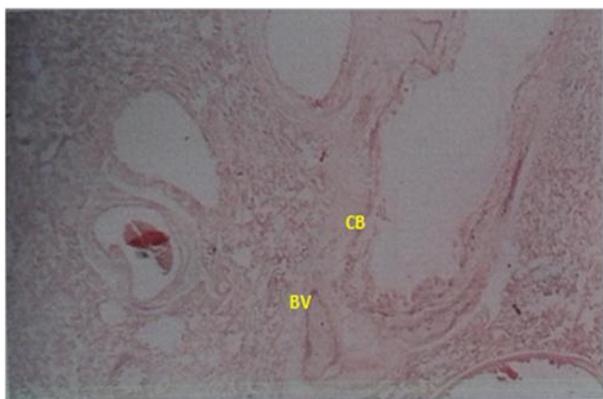


Figure 6: Histological sections of 40 weeks showing alveolar phase cartilagenous bronchi (CB), alveolar ducts (A) and blood vessels (BV), magnification 10 x 10x.

DISCUSSION

The development of lung buds, trachea and bronchopulmonary segments were observed in specimens of less than 6 weeks gestational age (Figure 1) and at 12 weeks of gestational age we observed larger bronchi with thick epithelium, pseudo glandular stage and budding of bronchial tree. According to Mossman, Boyd, (1964⁵); Inderbir Singh (2003⁶) development of lung buds, trachea, bronchopulmonary segments and larger bronchi with thick epithelium, pseudo glandular stage begins at 4-6 week of gestational age. The findings in the present study in agreement with literature.

At 16 weeks of gestational age we observed the lung appeared like a compound racemose gland, this represents features of pseudo glandular phase (Figure 2 & 3). A. K. Datta (2005⁷) reported development of pseudo glandular phase begins between 6-16 weeks gestational age. In our study there was a delay in the appearance of pseudo glandular phase.

Specimen with 30 weeks of gestational age (Figure 4) shows overlapping of pseudo glandular and canalicular phase. According to Clarkson, 1959;⁸ Moore & Persaud 1999;² mednet.com⁹) Overlapping of pseudo glandular and canalicular phase developed at 26 weeks of gestational age, Longman (1990¹⁰) reported canalicular phase develops at 16 weeks-26 weeks of gestational age. We observed that there was delay in the appearance of pseudo glandular and canalicular phases.

Gestational age of 30 weeks specimen shows (Figure 4) terminal sacs with thin cuboidal epithelium, capillaries begins to bulge into developing alveoli & intimate contact between epithelial and endothelial cells established the blood air barrier were observed. Longman (2006¹⁰ & www.survanta.com⁹) stated terminal sacs within cuboidal epithelium, capillaries begins to bulge into developing alveoli & intimate contact between epithelial and endothelial cells established the blood air

barrier were observed from 24 weeks to birth. we observed that there was delay in the appearance of terminal sacs with thin cuboidal epithelium, capillaries begins to bulge into developing alveoli & intimate contact between epithelial and endothelial cells established the blood air barrier.

At 40 weeks of gestational age specimen shows squamous epithelium lining the alveoli, increased number of respiratory bronchioles, terminal bronchioles and alveolar ducts (Figure 5 & 6). According to John D. Bancroft (2002¹¹); www.survanta.com¹² squamous epithelium lining the alveoli, increased number of respiratory bronchioles, terminal bronchioles and alveolar ducts developed from 32 weeks to 8 years after birth. In the present study there was a delay in the maturation of lungs.

CONCLUSION

The findings in the present study stating that there was a delay in the appearance of embryonic, pseudo glandular phase, canalicular, terminal saccular and alveolar stages. Development of lung buds, trachea, bronchopulmonary segments and larger bronchi with thick epithelium, pseudo glandular stage begins at less than 4-6 week of gestational age. This is in agreement with literature. Delay in the developmental anatomy and histogenesis of the lung cells leads to histopathological abnormalities which gives knowledge to the clinicians during clinical procedures.

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