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THE EVOLUTION OF *PHUPPHUSA UTPATTI*: A MODERN SCIENTIFIC PERSPECTIVE

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ABSTRACT

The first oldest understanding of *Gunas, Doshas, Panchamahabhuta,Srishti-uttpatti,* and other concepts comes from Ayurveda. Samhitas are collections of wisdom that the sages have assembled. A Samhita that provides detailed information on human anatomy is the Sushruta Sharira, which describes how the human body originated long before contemporary science developed the field of embryology. Comprehensive research has been done on embryology, and there is always more to discover. This article will help us to draw parallels between the Ayurvedic concept of *Phupphus Utpatti* and the contemporary understanding of organogenesis.

Keywords: Ayurveda, *Avayava utpatti*, Human Embryology

INTRODUCTION

Acharya Sushruta's explanation of the role of *Panchmahabhutas* (the five elements) in the development of *Garbha* (embryo) is comprehensive and profound. Let's explore each of these roles as elucidated by him:

Vayu: *Vayu* plays a crucial role in cell division and multiplication (*Vibhajana*) during embryonic development. This involves the process of cell division, where a single fertilized egg undergoes multiple rounds of division to form a multicellular organism. *Vayu's* attributes of movement and motion are reflected in this dynamic process of cellular proliferation.[1]

***Teja*:** Teja, representing the element of fire, performs the function of transformation (*Pachana*) during embryonic development. This involves the metabolic processes necessary for the growth and differentiation of cells. Teja facilitates the transformation of nutrients into energy and building blocks required for developing various tissues and organs. .[1]

Apa: Apa, or water, moistens (*Kledana*) during *Garbha Nirmana*. This involves the hydration of cells and tissues and the facilitation of fluid dynamics within the developing embryo. Adequate moisture is essential for the proper functioning of cellular processes and the maintenance of tissue integrity.[1]

***Prithvi*:** Prithvi, representing the earth element, plays a vital role in consolidation (*Sanghanana*) during embryonic development. This involves the process of tissue organisation and structural integrity. Prithvi's attributes of stability and solidity contribute to the formation of tissues and organs with defined boundaries and functions.[1]

***Akasha*:** *Akasha*, the space element, performs the function of space formation *(Vivardhan)* during *Garbha Nirmana*. This involves the spatial arrangement of cells and tissues to form the complex structure of the embryo. *Akasha* provides the framework within which cellular processes occur, and organs develop, ensuring proper organisation and spatial orientation.[1]

By understanding the roles of these *Panchmahabhutas* in embryonic development, as elucidated by Acharya Sushruta, we gain insights into the holistic and interconnected nature of the developmental processes. Each element contributes its unique attributes to ensure the orderly and harmonious formation of the embryo, reflecting the intricate balance inherent in the principles of Ayurveda.

AIM:

To correlate the Ayurveda concept of *Phupphus* Utpatti with a modern aspect of organogenesis.

REVIEW OF LITERATURE:-

Ayurvedic perspective of the origin of lungs

According to Parishadyam sabdarth shariram and Sanskrit Kaustubh shariram phupphus are considered lungs(*fefdha*)[2],[3].

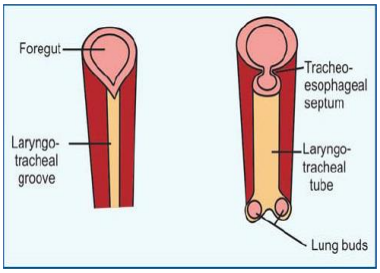
According to Acharya Sushruta lungs in the womb originate from the foam of blood.[4] Ashtanga Samgraha has also explained that the lungs are formed from the froth of blood.[5][6]

Synonym of *fena* is,*jhaag*, froth, foam, bubbles etc.

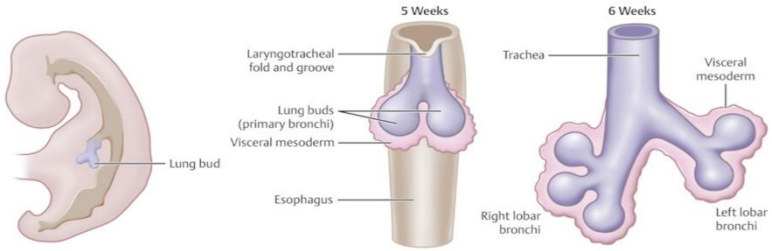
Modern perspective of the origin of lungs.

Development of the Lungs

The respiratory system develops during the fourth week from the ventral wall of the pharyngeal part of the foregut caudal to the hypobranchial eminence.



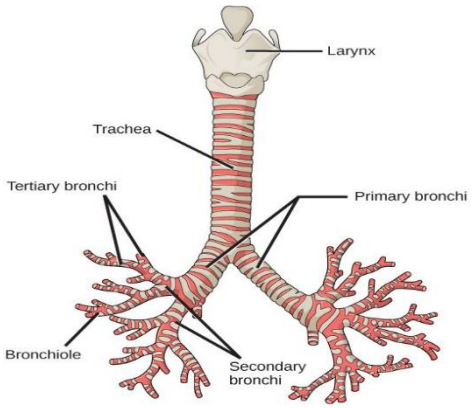
It develops as a median groove-like evagination known as the tracheal groove. The groove extends gradually in the caudal-cranial direction and forms the laryngotracheal tube. The tube grows caudal wards and bifurcates into the right and left lung buds. Each lung bud bulges and projects into the pleural coelom.



Stages of maturation of lungs

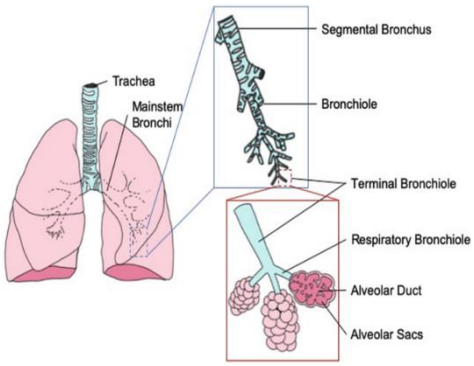
Pseudo glandular stage

Pseudo-glandular stage, lasting between five and sixteen weeks. The formation of the left and right primary bronchi occurs at this stage. Three secondary bronchi form on the right side. Two secondary bronchi form on the left side. Twenty tertiary bronchi grow on the right side. Eighteen tertiary bronchi and terminal bronchioles develop on the left side.[7]



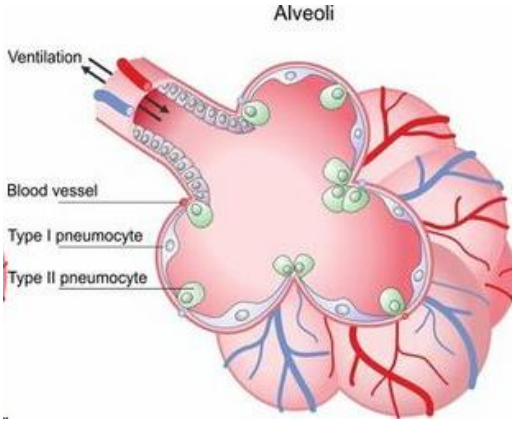
Canalicular stage

stage canalicular, which extends from week 16 to week 26. The development of the pulmonary capillaries, primitive alveoli (immature), and respiratory bronchiole occurs.[7]



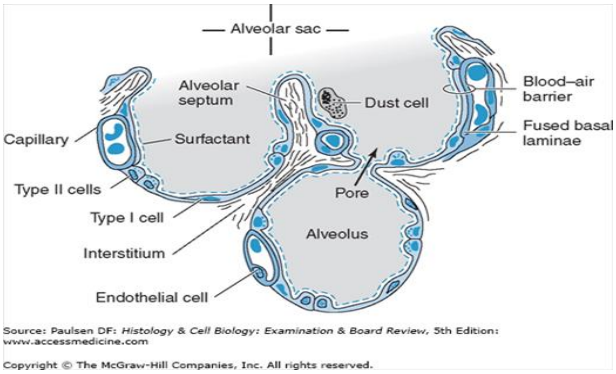
Saccular stage

Stage Saccular, which extends from week 26 to birth. This stage is characterised by an increase in the number of alveoli and the formation of the basement membrane in the respiratory bronchioles, as well as an increase in the number of pulmonary capillaries that contain cuboidal cells, which are flat (type 1 gas exchange) and type 2-cells.[7]



Alveolar stage

The Alveolar stage, which lasts from week 36 to eight years, is the fourth stage. The number of alveoli increases, and Type 1 and Type 2 cells continue to form. Septum formation to enhance the alveolar surface area. Increased pulmonary capillaries and basement membrane formation.[7]



ORIGIN

The mesoderm is where blood originates. The lung is formed by endoderm and mesoderm.

The glands in the respiratory epithelium, bronchi, alveoli, and trachea are endodermal in origin. Mesoderm gives rise to muscles, cartilage, airways, and connective tissue (fibrolamellar stroma)[8].

DISCUSSION

All the Acharyas (Acharya Sushruta, Vagbhata, Bhavaprakash) have stated that lungs originate from the *fena* of blood.

According to modern, Lungs originate from the Endoderm of the Pharyngeal part of the Foregut in the 4th week of IUL, which grows further Caudally, forms the Laryngotracheal groove and gets converted into the Laryngo tracheal tube. The upper end of this tube forms the larynx. The trachea is formed from the intermediate part, and the caudal end bifurcates to form a pair of lung buds.6th Pharyngeal arch forms- pulmonary artery and ductus arteriosus. The mucous membrane of the Lung Alveoli of the Respiratory passage is formed from the Endoderm of the Fore gut and Musculature, Cartilage, and Fibro areolar stroma from the Splanchnic mesoderm. Lung matures in 4 stages – Pseudo glandular stage, Canalicular stage, Saccular stage, Alveolar stage. There are some special cells in the respiratory passage which produce surfactant. These surfactants form a thin layer in the alveoli and reduce surface tension. The pleural cavity of the lungs forms between 4-7 weeks of embryonic development.

Prithvi and *Vayu* are the main elements of the Lungs. *Prithvi Mahabhuta* provides shape to the lung, *Vayu Mahabhuta* is an air-filled Alveoli, *Akasha Mahabhuta* is responsible for the formation of space*(Aakash)* inside the lungs and alveoli, *Teja Mahabhuta* performs the functionality of the lungs, and *Jala Mahabhuta* keeps the cells clustered together.

Fibro-alveolar lung stroma is formed from Mesoderm, and blood is also formed from Mesoderm. The appearance of fibro-areolar stroma appears like foam of blood.

What is *Fena* before birth?

During fetal development, the structure of Alveoli is fully developed but not functional. It appears like a bubble. Since the appearance of alveoli during fetal development is also foam-like, the origin of the lungs seems to be blood foam.

What is *Fena* after birth?

The alveoli achieve structural and functional maturity after birth.

When the lungs become active after birth, air reaches the alveoli, and gaseous exchange takes place. Lungs are like sponges, with innumerable small spaces filled with air.

When the lungs are cross-sectioned, a foamy red liquid substance emerges, similar to the foam of blood.

CONCLUSION

Hypothesis regarding the origin of lungs: During the first 3 months of the gestational period, the fetus's lungs develop their structural framework, followed by the maturation of their functional aspects. As the lungs expand, the internal surface of the lung cavity containing surfactant gives rise to a concave appearance known as alveoli.

Just as raindrops transform into bubbles the moment they hit the ground, in the same way, when maternal blood descends due to gravitational force and enters the lung cavity through the hilum, it forms numerous bubbles. Ancient scholars, keeping this phenomenon in mind, have considered that lungs originate from the *Fena* of blood.

In the context of the origin of the lungs, all scholars agree that they originate from the froth of the blood.

Here, the term "*fena*" has been interpreted as referring to the alveoli, emphasising the functional rather than the structural perspective. The primary function of the lungs in a living body is to facilitate gaseous exchange, which occurs in the alveoli. If the lungs are formed but the alveoli are not functional, the person cannot survive. This highlights that the lungs are more significant from a functional standpoint. It also suggests that the scholars have placed greater importance on the functional aspect, interpreting "*Fena*" as referring to the alveoli.

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