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Anatomy

RELATIONSHIP BETWEEN TRACHEAL BIFURCATION AND PULMONARY TRUNK BIFURCATIONS

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ABSTRACT **INTRODUCTION:** Ventral side of the pulmonary trunk bifurcation corresponds to tracheal bifurcation.The pulmonary trunk is slightly more caudal then tracheal bifurcation and is related to it. OBJECTIVE: The recognition of relation of tracheal bifurcation and pulmonary trunk bifurcation to prevent to avoid the devascularization of a lobe or segment left in place during pulmonary excision. METHODS: Trachea with right and left principle bronchus and heart with pulmonary trunk obtained from 30 cadavers of age group 18-75 yrs on whom medicolegal postmortem had been conducted in the department of Anatomy and Forensic , LHMC &SSKH . **RESULTS:** The tracheal bifurcation formed an angle of 76° , the bifurcation of trachea and pulmonary trunk makes a triangular ,rectangular,quadrangular and asymmetric interbifurcal space. The pulmonary artery trunk is located about 3 cm caudal to the tracheal bifurcation. **CONCLUSIONS** :Recognition of pulmonary artery branches variation is necessary to avoid devascularization of lobe during its resection.

KEYWORDS : TRACHEAL BIFURCATION ,PULMONARY BIFURCATION

INTRODUCTION –

The bifurcation of the pulmonary trunk and trachea were followed on 30 cases being appreciated on the dissection. Ventral side of the pulmonary trunk bifurcation corresponds to tracheal bifurcation[1]. The pulmonary trunk is slightly more caudal then tracheal bifurcation and is related to it[2]. Shortly after exiting from the fibrous pericardial sac, pulmonary trunk splits in T, the two terminal branches, right and left, moving away from each other, forming an obtuse angle of 130-150O opened posterior superior and to the right [3]. The bifurcation of the pulmonary trunk and trachea makes with bronchus a rhombic interbifurcal space. This interarterio-bronchial area is triangular when the inferior basis is formed exclusively to right pulmonary artery and to the pulmonary trunk bifurcation and the top to tracheal carina. The trachea bifurcation corresponds to the middle of the left main bronchus about 2.5 cm from the trachea bifurcation, the left pulmonary artery do not participate in the formation of the interbifurcal space. This space consists of intertracheobronchial lymph nodes [1,2,4,5,6,7,8,9]. After [2,3], tracheal bifurcation is surrounded in front and rear by many branches of the vagus and sympathetic system which constitute the lung plexus.

MATERIAL AND METHODS: Trachea with right and left principle bronchus and heart with pulmonary trunk obtained from 30 cadavers of age group 18-75 yrs on whom medicolegal postmortem had been conducted in the department of Anatomy and Forensic , LHMC &SSKH . These lungs were retrieved from the donated and unclaimed bodies, registered to departments with known cause of death, unrelated to pulmonary diseases, from the age group of 18 years and above. All samples were collected after following the standard protocol for ethical clearance .

OBSERVATIONS : The tracheal bifurcation formed an average angle of 76O, the bifurcation of trachea and pulmonary trunk makes a triangular ,rectangular, quadrangular and asymetric interbifurcal space. This interbifurcal area was triangular, when the base was formed by pulmonary trunk and right pulmonary artery and apex by tracheal bifurcation. The pulmonary artery trunk is located about 3 cm caudal to the tracheal bifurcation. When the left pulmonary artery also took part in the formation of space, then it formed a quadrangular interbifurcal space. The left primary bronchus was related to left pulmonary artery anterosuperiorly and right primary bronchus to right pulmonary artery anteroinferiorly in present study.

Ventral side of the tracheal bifurcation corresponded to the pulmonary artery bifurcation and the branches of pulmonary artery. The pulmonary artery trunk bifurcation only was slightly more caudal to the tracheal bifurcation and slightly left lateral, hence the area was formed between the 2 bifurcations known as interbifurcal space. But in one case the pulmonary bifurcation overlaped the tracheal bifurcation anteriorly and hence it did not form any interbifurcal space(Diagram 3). Shortly after exiting from the fibrous pericardial sac, pulmonary trunk split in T, the two terminal branches, right and left, moving away from each other, formed an obtuse angle of 130-150º. In one case (3.3%) the pulmonary arteries did not bifurcate into exactly 2 branches, but the rt and lt pulmonary arteries seemed like the branches of pulmonary trunk coming out from 2 different places of pulmonary trunk(Diagram 2). The tracheal bifurcation formed an angle of 76º, the bifurcation of the pulmonary trunk and trachea makes a triangular or quadrangular interbifurcal space. This interbifurcal area was triangular, when the base was formed by pulmonary artery trunk and right pulmonary artery and apex by tracheal bifurcation. The pulmonary artery trunk bifurcation is located about 3 cm caudal to the tracheal bifurcation. The trachea bifurcation corresponded to the middle of the left main bronchus about 2.5-3.5 cm of trachea carina, the left pulmonary artery did not participate in the elaboration of the interbifurcal space, in this case it forms a triangular interbifurcal space(Diagram 1). When the left pulmonary artery also took part in the formation of interbifurcal space, then it formed a quadrangular interbifurcal area(Diagram 2). In the interbifurcal space consisted of intertracheobronchial lymph nodes.

The left primary bronchus was related to left pulmonary artery anterosuperiorly and right primary bronchus to right pulmonary artery anteroinferiorly . Right upper, middle and lower lobar bronchus were related anterosuperiorly to pulmonary artery. Left upper and lower lobar bronchus were related anterosuperiorly to pulmonary artery. Right segmental bronchi were related anterosuperiorly to branches of right pulmonary artery. Left segmental bronchi were related anterosuperiorly to branches of left pulmonary artery(Diagram 4).

The pulmonary artery branching corresponded to the branching of tracheobronchial tree as it was intimately related to it for better gaseous exchange.

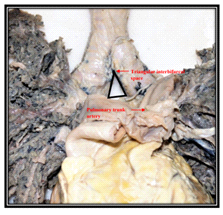

Diagram 1 :Triangular interbifurcal space

Diagram 2 :Quadrangular interbifurcal space, right and left

pulmonary artery

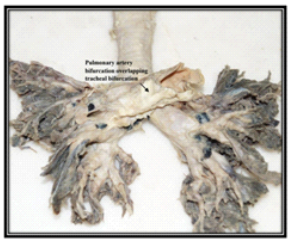

Diagram 3 :Pulmonary artery bifurcation overlaping tracheal bifurcation

Diagram 4: Pulmonary artery relations with tracheobronchial tree

DISCUSSION

SUBCARINALANGLE

The subcarinal angle is the angle between the right and left main bronchus(Diagram 4). Increase in the angle was mentioned as an indirect sign of pathology in the heart or mediastinum such as left atrial enlargement, generalized cardiomegaly, lobar collapse, subcarinal mass or pericardial effusion. This knowledge was also helpful for smooth conduction of some maneuvers like endotracheal intubation and bronchoscopic procedures.

The mean of subcarinal angle in cadavers was observed as 76.90±11.58 with the range of 60-99mm.

TABLE 1: COMPARISON OF SUBCARINAL ANGLE IN CADAVERS

GROSS	PRESENT STUDY	JIT H & JIT I[10]	HASKIN ET AL[11]	CHUNDER R & GUHA R[12]	CHUNDER ET AL[13]
Subcarinal Angle	76.9	51.28 in males 55.01 in females	61.45	59.1in males 53.1 in females	54.4

The present study did not correlates with any of the studies stated above.

PULMONARY ARTERY RELATIONS WITH TRACHEOBRONCHIALTREE

The main function of lung is diffusion and exchange of respiratory gases. Interwoven airway and vascular tree help in delivery of air and blood to alveolar capillary surface. These bronchovascular trees undergo serial branching and ramify into complex structures with 70 million precapillary arterioles, 480,000 alveoli and 280 billion capillary segments.[17]

The tracheobronchial tree was central to efficient gas exchange and the design was accurately constructed in each individual. The volume of the conducting system must be minimized to decrease wasted ventilation and the work of breathing. The surface area for gas exchange must be maximized while being constrained to the volume of the chest cavity.

The recognition of the pulmonary artery branches variations during the pulmonary excision was necessary to avoid the devascularization of a lobe or segment left in place, some areas, of the lower lobes in particular, may receive systemic arteries originating directly from the aorta. In the lung, the pulmonary artery branches follow the bronchi till the terminal bronchiole.

CONCLUSIONS :

Tracheal and pulmonary trunk bifurcation formed triangular and quadrangular interbifurcal space. The right primary bronchus was related anteroinferiorly to right pulmonary artery and left primary bronchus was related anterosuperiorly to left pulmonary artery. Rest all the branches of pulmonary artery runs anterosuperiorly to the bronchus till the segmental bronchi. In 3.3%cases the pulmonary artery do not bifurcate into exactly 2 branches, but the rt and lt pulmonary artery seems like the branches of pulmonary trunk coming out from 2 different places of pulmonary trunk.

The recognition of the pulmonary artery branches variations leading to geometrical spaces formation is of importance in pulmonary excision of a lobe or a segment to avoid the devascularization of a lobe or segment left in place.

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