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Relations between the tracheal and pulmonary trunk bifurcations

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ABSTRACT

The bifurcation of the pulmonary trunk and trachea were followed on 52 cases being appreciated on the dissection and corrosion pieces and CT examinations, the arterial bifurcation being made under an very variable angle, its value ranging from 30-1080. In 82% of cases the tracheal bifurcation was done under an acute angle, with lower value than the arterial bifurcation angle. In 41 cases (78.85% of cases) the pulmonary trunk bifurcation is done under the bifurcation of the trachea, at a distance of between 0,4 - 2,8 cm, and in 8 patients (15.38% of the cases) the two bifurcations was located at the same level. Only in 3 cases (5.77% of cases), all on CT angiography, we encountered the pulmonary trunk bifurcation above tracheal bifurcation, with 0.3-0.8 cm, bifurcation of the pulmonary trunk being left lying of the tracheal bifurcation. In these cases, the bifurcation angle of the pulmonary trunk is always greater than the angle of the trachea bifurcation. On the dissected and the corrosion pieces is found that when the bifurcation is situated at different levels, the tracheal one being located cranial, the most commonly between them form a rectangular area: rhombus, more frequently, and rectangular or trapezium and rarely a pentagon or triangle. Any geometric shape to be formed between the two junctions, it is often asymmetric.

Keywords: tracheo-pulmonary bifurcation relations.

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Introduction

By [1], the tracheal bifurcation is formed by the end of the trachea and the origin of the two main bronchi, right and left, this constitutes the main element of the termino-tracheal region of Latarjet and Juttin. Ventral side of the tracheal bifurcation corresponds to the pulmonary artery bifurcation and his right branch [2,3,4,5,6,7]. The pulmonary bifurcation whole only is slightly more caudal then tracheal bifurcation and slightly left lateral [1,4,6,7], for [1,2,3] the bifurcation of the pulmonary artery trunk and the its right ram situated on a lower plane of tracheal bifurcation and for [5] of the pulmonary trunk bifurcation opposing tracheal bifurcation, located anterior and superior and left of it entirely to the left midsagittal plane. 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 130-1500 opened posterior superior and to the right [2,3,4,5,8] and contrary to the opinion of some anatomists, they are not strictly continued one of the other. After [9,10], the tracheal bifurcation forms an angle of approximately 70o. [1] states that the bifurcation of the trachea is an asymmetric device, right bronchus having an almost vertical direction, the angle which it makes with the vertical plane not exceeding 20 - 300, left bronchus being almost horizontal, making with the horizontal an angle of 40-

50o. By [4], pulmonary arterial bifurcation is under a superior and right open angle, corresponding to the posterior left bronchus, near its lower face. This angle is the anterior-inferior and to the left of the aortic arch, which is joined by arterial ligament to the left pulmonary artery. The bifurcation of the pulmonary trunk and trachea makes with bronchus a rhombic space [1], interbifurcal space. By [5] this area interarterio-bronchial is rather triangular, inferior basis corresponding exclusively to right pulmonary artery and to the pulmonary trunk bifurcation and the top to tracheal carina. This fact is because the pulmonary artery trunk bifurcation is located immediately anterior to the lower edge of the left bronchial about 2.5 cm from tracheal bifurcation (Paturet). By [6,7], the trachea bifurcation corresponds to the middle of the left main bronchus about 2-2.5 cm of trachea carina, the left pulmonary artery do not participate in the elaboration of the interbifurcal space. In this space are intertraheobronchial lymph nodes [1,2,3,5,6,7,9,10]. After [2,3], tracheal bifurcation is surrounded in front and rear by many branches of the vagus and sympathetic system, which, when assembled constitute the lung plexus.

Material and Methods

Our study was conducted on a total of 52 cases, using as study methods dissection, plastic injection (Technovit 7143) followed by corrosion and analysis of CT examinations, performed on a GE LightSpeed 16 Slice CT scanner and a computer Slice CT Scanner GE LightSpeed VCT64 Slice CT.

Results

Bifurcation of the pulmonary trunk, appreciated

on dissection and corrosion pieces and angiography examinations (in 52 cases), has an angle very variable in size, its value ranging from 30-1080.

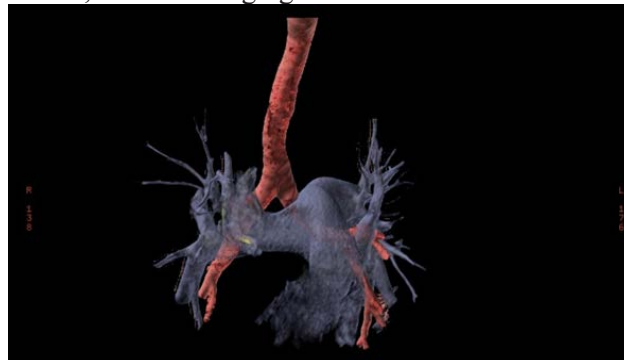


Figure 1 - Bifurcation of the pulmonary trunk left to the tracheal bifurcation.

In 16 cases (47.06% of cases) angle was between 30-700, in 9 cases (26.47% of cases) with values between 40-500; in 18 cases (52.94% of cases), the bifurcation angle ranged from 71-1080, in 9 cases (26.47% of cases) values ranging from 90-990.



Figure 2 - Bifurcation of the pulmonary trunk in an acute angle, with an asymmetrical rhomb between the tracheal and pulmonary trunk bifurcations.

The bifurcation of the pulmonary trunk was doing in 41 cases (78.85% of cases) under the tracheal bifurcation, at a distance of between 0.4 - 2.8 cm, and in 8 patients (15.38% of the cases) the two bifurcation organs was located at the same level. Only in 3 cases (5.77% of cases), all on angiography, we encountered the bifurcation of the pulmonary trunk situated under

the of tracheal bifurcation, with 0.3 - 0.8 cm, the bifurcation of the pulmonary trunk being left lying all tracheal bifurcation, which was ordered back to the right pulmonary artery.



Figure 3 - Bifurcation of the pulmonary trunk caudal to the tracheal bifurcation, same plane, with an asymmetrical rhomb between the tracheal and pulmonary trunk bifurcations

In these cases, the angle of bifurcation of the pulmonary trunk is always greater than the angle of bifurcation of the trachea. On the dissected and the corrosion pieces is found that when the bifurcation is situated at different levels, the trachea being located cranial between them form a rectangular area most commonly: rhombus, more frequently, and rectangular or trapezium and rarely a pentagon or triangle. Any geometric shape to be formed between the two junctions, it is often asymmetric.

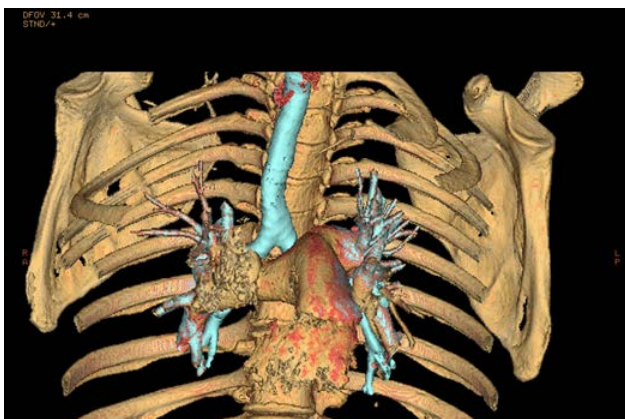


Figure 4 - Bifurcation of the pulmonary trunk at inferior half of the T5, same level with the tracheal bifurcation.

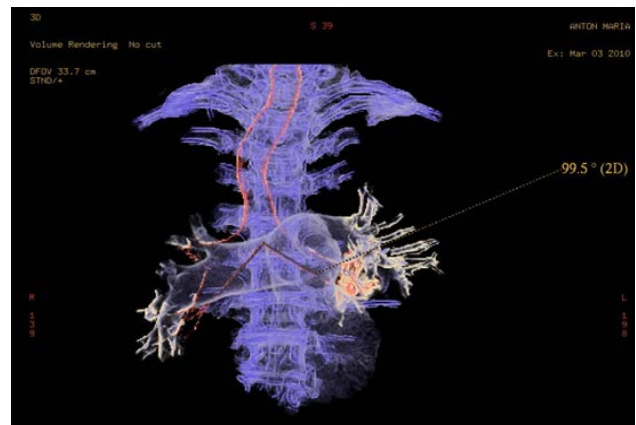


Figure 5 - Bifurcation of the pulmonary trunk slightly left and above the inferior half of T5.

The pulmonary trunk bifurcation is located, most common, caudal and to the left of tracheal bifurcation above the left main bronchus or even the left upper right lobar bronchus. More rarely overlaps tracheal bifurcation, to which is located above. Also rarely is the bifurcation of the pulmonary trunk is caudal and to the same vertical plane with tracheal plane. In relation to the vertebral column, bifurcation of the pulmonary trunk is between the middle of vertebra T5 - middle of vertebra T6, tracheal bifurcation always finding different levels of T5 vertebra.



Figure 6 - Interbifurcal space triangular in shape (A) or irregular quadrangle

Discussion

Regarding the bifurcation of the pulmonary trunk, [9.10] states that the left pulmonary artery does not participate in the formation of interbifurcal space, because arterial bifurcation is made above the left main bronchus. Because of this, he finds only interbifurcal space as triangular shape. This form I found it too, but in a small percentage, most commonly interbifurcal space being quadrilateral. Even when space was triangular, he submit this form only anterior, posterior could be irregular quadrilateral, and the left pulmonary artery participate in the formation of it with 2-3 mm, something which I met only 3 cases (5.77% of cases). This is because of the posterior slope of left pulmonary artery suprabronchic convexity, something that I have not found it quoted in the literature. [6] find the interbifurcal space rhombic-shaped aspect that I met it frequently, and the pentagonal shape of this space, we've met it sometimes but not found it cited in the literature consulted.

Sometimes the right pulmonary artery presents on its upper middle portion a slight depression, which makes the interbifurcal space to be quadrilateral, although bifurcation of the pulmonary trunk, is made above the left main bronchus. In these cases, the lower sides of the quadrilateral are formed by the right pulmonary artery, the upper sides being formed by the two main bronchi, right and left. In cases where the bifurcation of the pulmonary trunk is made inferior and to the right of the left main bronchus, the interbifurcal space had a pentagonal shape, the sides being formed as follows: the two upper sides were formed by the two main bronchi, right and left; two lower sides were formed by the right pulmonary artery and the fifth side, left infero-lateral was formed by the left pulmonary artery.

Comparing the bifurcation angles of the pulmonary trunk and trachea, they are variable and generally differ in value from each other, the tracheal bifurcation being made most frequently under angle, with lower value than the pulmonary artery. Rarely those two angles have the same value, in which case the interbifurcal space had a regular rhombic shape,

with the large axis vertical.

Conclusions

The recognition of the pulmonary artery branches variations during the pulmonary excision is 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 and cross triangular ligaments. In the lung, the pulmonary artery branches follow the bronchi, which are in contact. Similarly, to bronchus the artery branches out, and follows up to the terminal bronchiolitis. Sometimes it is possible that the ramifications of the pulmonary artery to be less regular than bronchial branching, arterial branches being made earlier than bronchial ramifications, so there is a gap between the origins of the bronchi and the artery of the same segment. In general, the tracheal bifurcation do not coincide with the bifurcation of the pulmonary trunk, sometimes this mismatch being maintained also at lobar level, most commonly to the lower lobe. The two bifurcation variants are numerous and differences between different authors are due to the number of cases that made statistical, study methods used, but especially morphological characteristics on anatomical pieces that measurements were performed: fresh pieces or formalinized, or measurements on ultrasound or CT images.

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