

Branching Pattern of Bronchial Tree Inboth Lungs

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Abstract: The portion of lung tissue which is aerated by individual tertiary bronchus is called bronchopulmonary segment.This is supplied by separate pulmonary artery and drained by common intersegmental vein.The knowledge aboutbranching pattern of bronchial tree is important during surgical resection of segments, procedures like bronchoscopy&to advice the suitable position for the patient in case of lung abscess.There are not so many articles for this study, but text books have documented variations in the branching pattern of bronchial trees of lungs. Knowledge about variations in the branching pattern of bronchial tree will helpful in surgical procedures and clinical management of the lung diseases. In present study variationswere seen in right middle lobar bronchus,right upper lobe tertiary bronchus&left lingular bronchus.

Keywords: Lungs, bronchus, bronchopulmonary segments.

I. Introduction

Lungs are vital organs for respiration. It is situated in the thoracic cavity. Each lung is divided by fissures into lobes. The right lung has 3 lobes separated by the oblique and horizontal fissure. The left lung has 2 lobes separated by the single oblique fissure. The trachea divides into two principal bronchi. The principal bronchus for each lung divides into lobar bronchi of which there are three on the right side and two on the left which passes to the corresponding lobes of the two lungs. The lobar bronchus then divides into segmental bronchi. There are so many studies for fissures and lobes of lungs available. But for the bronchial tree dividing pattern, less no of articles only present. For that, this study may act as aone of the adding factor.

In this study the following branching pattern were studied

- 1)Right principal or primary bronchus
- 2)Right lobar or secondary bronchus
- 3) Right segmental or tertiary bronchus
- 4) Left principal or primary bronchus
- 5)Left lobar or secondary bronchus
- 6)Left segmental or tertiary bronchus

II. Materials & Methods

Specimen collection:

25 pairs of lungs collected from cadavers which were allotted to the 1st MBBS & 1st BDS students at the Institute of Anatomy, Madras Medical College, Chennai. In 5 pairs of lungsthebranching pattern were studied by dissection method & by luminal cast method in 20 pairs of lung.

A.Dissection Method

The lung parenchymatous tissue was removed by the piecemeal dissection. The branching pattern of bronchial tree was identified and named.

B. Luminal Casting Method

The tracheal lumen was washed with tap water&with sodium chloride (NaCl) solution. After that the lung was kept upside down till all the water has been drained. Then thebronchial treeof both sides were filled by the white silicone gel by using gun& allowed to dry for 48 hours.After that,it was immersed in commercial hydrochloric acid solution (Hcl) for 48 hours. The soft tissues were dissolved by acid, the branching bronchial tree obtained from the acid solution.

III. Observations

Right side branching pattern of bronchial tree (Fig :O1A,O1B)

In present study, Right principal bronchus arises from the trachea in all specimens (100%).The Right superior lobe bronchus arises from the right principal bronchus in all specimens (100%). Middle lobar bronchus arises from the intermediate stem of right bronchus in 24 specimens (96%) except in one specimen(Fig:O2)

(4%) in which middle lobar bronchus arises from the superior lobar bronchus. After giving the middle lobar bronchus, the intermediate stem continues as inferior lobar bronchus in all specimens (100%). Normally the right upper lobe tertiary bronchus divides into three segments viz apical, anterior and posterior. The right upper lobe tertiary bronchus divides into two stems viz anterior & posterior segments (Fig: O3) in 11 (44%) specimens. In 14 (56%) specimens the right upper lobe tertiary bronchus divides into 3 stems as usually. All the (100%) specimen of right middle lobe tertiary bronchus divides into two stems (i.e) lateral and medial. All specimens (100%) show normal branching pattern of right lower lobe tertiary bronchus (apical basal, anterior basal, posterior basal, medial basal & lateral basal).

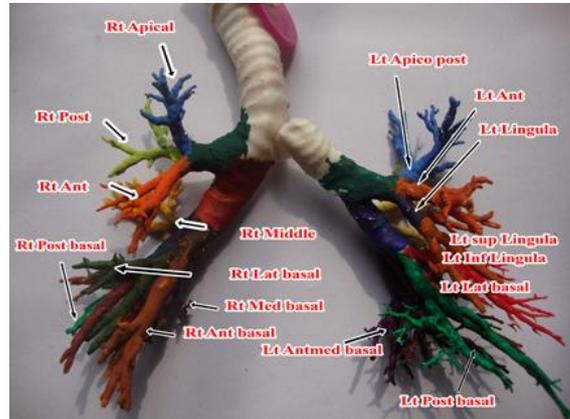


Fig: O1A Shows bronchial tree in dissection method. Fig: O1B Shows bronchial tree in luminal cast method



Fig: O2 shows right middle lobar bronchus from upper lobar bronchus.



Fig no: O3 Bifurcation of right upper lobar bronchus (Bifurcation)

Left side branching pattern of bronchial tree(Fig:O1A, Fig:O1B)

In present study, the left principal bronchus arises from the trachea in all specimens (100%). The superior lobar bronchus arises from the left principal bronchus in all specimens (100%). The superior lobar bronchus divides into upper lobar bronchus (upper division) and lingularlobar bronchus (lower division) in 23(92%) specimens. Lingularlobar bronchus arises from the inferior lobar bronchus(Fig:O4) in two specimens (8%). The upper division of superior lobe tertiary bronchus bifurcates into two stems, apicoposterior and anterior and lingular lobe(lower division) tertiary bronchus divides into lateral and medial in all specimens(100%). In present study, 25(100%) specimens show normal bifurcation and all specimens (100%) show normal dividing pattern of inferior lobe tertiary bronchus.



Fig no:O4lingular bronchus from the inferior lobe bronchus

IV. Discussion

1)Right principal bronchus

In present study, right principal bronchus arises from the trachea in all specimens(100%). This coincides with the authors of Henry Hollinshead⁷, Gray's¹⁶, T.S.Ranganathan¹⁰, Chummy S.Sinnatamby⁶ statement.

2)Right lobar or secondary bronchus(A) Right superior lobar bronchus

In all specimens (100%), the right superior lobar bronchus arises from the right principal bronchus. This coincides with the authors of Chummy S.Sinnatamby⁶, Henry Hollinshead⁷, Keith L.Moore⁹, T.S.Ranganathan¹⁰ & Gray's¹⁶ statement.

(B)Right middle lobar bronchus

Middle lobar bronchus arises from the intermediate stem of right principal bronchus in 24 specimens(96%). This coincides with the authors of Henry Hollinshead⁷, Chummy S.Sinnatamby⁶, T.S.Ranganathan¹⁰ & Gray's¹⁶ statement

In one specimen(4%) the middle lobar bronchus arises from the upper lobar bronchus. The common origin of upper lobe and middle lobe from common stem in one specimen which coincides with authors of Dr.Senthamilselvi (2008)¹⁴ & Gray's anatomy (2008)¹⁶.

(C) Right inferior lobar bronchus

After giving the middle lobar bronchus, the intermediate stem continues as inferior lobar bronchus in all specimens(100%). This is similar to that of authors of Chummy S.Sinnatamby⁶, Henry Hollinshead⁷, T.S.Ranganathan¹⁰, Dr.Senthamilselvi(2008)¹⁴ & Gray's¹⁶ statement.

3. Right segmental bronchus:a.Upper lobe tertiary bronchus(Table D01, Chart: D 01)

In present study, 11(44%) specimen of the right upper lobe tertiary bronchus divides into two stems viz anterior, apicoposterior which coincides with the study of Keith L.Moore⁹, Boiden & Scannel T.G.(54%)(1948)¹¹ & Gray(2008)¹⁶.

When compared to Boiden & Scannel T.G.(1948)¹¹, the present study percentage for two stems dividing pattern of upper lobe tertiary bronchus is lower than the Boiden & Scannel T.G.(1948)¹¹. In 14(56%) specimens the right upper lobe tertiary bronchus divides into 3 stems viz apical, anterior and posterior which is higher than that of the study of Boiden & Scannel T.G.(46%)(1948)¹¹.

| S.no | Study | Right Upper lobe bronchus | |
|------|------------------|---------------------------|-------------|
| | | Trifurcation | Bifurcation |
| 1 | Boiden | 54% | 46% |
| 2. | Senthamilselvi.A | 65.6% | 3.1% |
| 3. | Present | 56% | 44% |

Table D:01 shows the branching pattern of right upper lobe bronchus

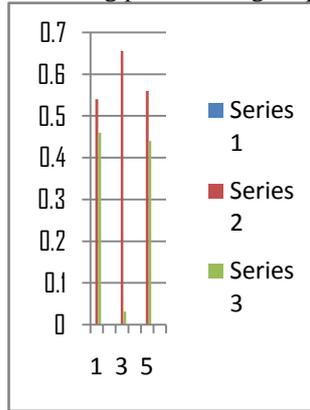


Chart no: D 01 shows the branching pattern of right upper lobe bronchus

b Right Middle Lobe tertiary bronchus

All the (100%) specimen of right middle lobe bronchus divides into two stems, lateral and medial. This is similar to that author's of the Keith L. Moore⁹, T.S.Ranganathan¹⁰, Boiden¹¹ & Gray (2008)¹⁶.

c. Right Lower lobe tertiary bronchus

Out of 25 specimens, all (100%) specimens show normal branching pattern of lower lobar bronchus. This normal pattern observed by Henry Hollinshead⁷, Keith L. Moore⁹, T.S.Ranganathan¹⁰ & Gray (2008)¹⁶.

5. Left principal bronchus

The left principal bronchus arises from the trachea in all specimens (100%) and divides into superior lobar and inferior lobar bronchus. This is similar to author's statement of Chummy S. Sinnathamby⁶, Henry Hollinshead⁷, T.S.Ranganathan¹⁰ & Gray's¹⁶.

6. Left lobar bronchus (A). Left superior lobe bronchus (Table D:02, Chart D:02)

The left superior lobar bronchus arise from the left principal bronchus in all specimens (100%). Then the superior lobar bronchus of left side divides into upper lobar bronchus (upper division) and lingular bronchus (lower division) in 23 (92%) specimens. This is similar to authors of Henry Hollinshead⁷, Keith L. Moore⁹, T.S.Ranganathan¹⁰ & Gray's¹⁶.

In 2 specimens (8%), the lingular bronchus (Table: D03, Chart: D03) arise from the inferior lobar bronchus. This is similar to the studies of the Boiden and Hartmann⁴, Chummy S. Sinnathamby⁶, Keith L. Moore⁹, T.S.Ranganathan¹⁰, Dr. Senthamil Selvi¹⁴ & Gray's¹⁶ statement.

| S.no | Study | Origin of lingular bronchus | |
|------|------------------|--|------------------------------|
| | | From superior lobe bronchus of left side | From Inferior lobar bronchus |
| 1. | Senthamilselvi.A | 93.7% | 6.3% |
| 2. | Present | 92% | 8% |

Table D:02 shows Origin of lingular bronchus of left side

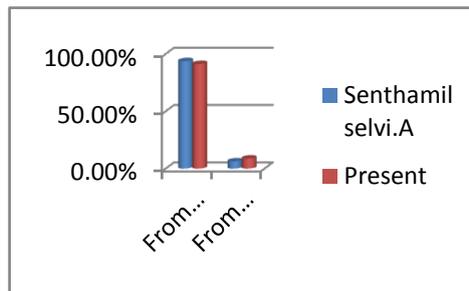


Chart D: 02 shows origin of lingular bronchus of left side

b) Left Inferior lobar bronchus

The left inferior lobe bronchus arises from the left principal bronchus in all specimens(100%). This pattern is observed by Chummy S.Sinnathamby⁶, Keith L. Moore⁹, and T.S. Ranganathan¹⁰&Gray¹⁶.

7.Left segmental bronchi or tertiary bronchus

(A)Upper division of superior lobe tertiary bronchus(Table:D03,Chart D 03)

Normally the upper division of superior lobe tertiary bronchus bifurcates into two stems, apicoposterior and anterior.In present study, 25(100%) specimens show normal bifurcation.This normal pattern observed byBoiden and Hartmann⁴, Chummy S.Sinnathamby⁶, Keith L. Moore⁹, and T.S. Ranganathan¹⁰&Gray¹⁶.

(B).Lowerdivision of superior lobe tertiary bronchus

Normally the lower division(Ligular division)of superior lobe tertiary bronchus divides into two stems,viz superior and inferior lingular divisions.In present study, all specimens (100%) have normal dividing pattern.This pattern observed byBoiden and Hartmann⁴,Chummy S.Sinnathamby⁶, Keith L. Moore⁹, and T.S. Ranganathan¹⁰&Gray¹⁶.

(C)Inferior lobe tertiary bronchus.

In present study, all specimens (100%) show normal dividing pattern of inferior lobar bronchus.This pattern is observed byChummy S.Sinnathamby⁶, Keith L. Moore⁹, and T.S. Ranganathan¹⁰&Gray¹⁶.

V. Conclusion

To conclude, the branching pattern of bronchial tree is not aconstant one. When reviewing the various text book authors, they mentioned the difference in arrangement of the bronchial trees. This study also showing the variation in bronchial tree branching pattern. Hence, anatomical knowledge about variation in branching pattern of bronchial tree is important not only for anatomist, physicians,surgeons and also for cardio-thoracic surgeons while planning and performing the procedures like pneumonectomy and lung transplantation and it will give the higher success rate in curative aspects.More studies about this type of topic, will refine the therapeutic aspect of the patient.

References

- [1]. Berg R.M., Boyden E.A., and Smith F.R. An analysis of variations of the segmental bronchi of the left lower lobe of fifty dissected and ten injected lungs. - J.thoracic surgery 18; 216 – 1949.
- [2]. Bhima Devi N.,B.NarasingaRao,V.Sunitha, Morphological variations of the lungA cadaveric study in north coastal Andhra pradsesh.
- [3]. Boyden E.A., and Hamre, C.J.An analysis of variations in the broncho vascular patterns of the middle lobe in fifty dissected and twenty injected lungs. J. thoracic surg. 21; 171 – 1951.
- [4]. Boyden E.A., and Hartmann J.F.An analysis of variations in the broncho pulmonary segments of the left upper lobes of fifty lungs. Am.J. Anat.79: 321 – 1946.
- [5]. Boyden E.A., and Scannell, J.G.An analysis of variations in the broncho vascular pattern of the right upper lobe of fifty lungs. Am. J. anat. 82: 27– 1948.
- [6]. Chummy S.Sinnatamby.Last’s Anatomy – regional & applied – 10thedition – R.J. Last – 1999– p.no: 206 – 210.
- [7]. Henry Hollinshead W. Ph.D, Text book of Anatomy, published by oxford,1962, p.no-549-561.
- [8]. Hollinshead– Text book of anatomy .Rosse C, Gaddum-Rosse P.Philadelph: Lippincott- Raven; 1977:441-61. - 1983 – p.no:223-284 .
- [9]. Keith L. Moore, Arthur F.Dally.Clinically oriented anatomy – 5th edition 2006 –p.no: 120-128 & 135.
- [10]. Ranganathan T.S., A textbook of human anatomy – 6th edition — 2011– p.no: 436 – 445
- [11]. Scannell J.G. and Boyden E.A.A study of variations of the bronchopulmonary segments of the right upper lobe. –J. thoracic surg. 17: 232 – 1948
- [12]. Scannell J.G.A study of variations of the bronchopulmonary segments of the left upper lobe. -1947
- [13]. ScannellJ.G.An anatomical approach to segmental resection of lung- -1949.
- [14]. SenthamilSelvi.A.An Anatomical study on bronchopulmonary segments-2007
- [15]. Smith F.R., and Boyden E.A.An analysis of variations of the segmental bronchi of the right lower lobe of fifty injected lungs. - J.thoracic surg. 18: 195 – 1949, surgery 18: 706, 945.
- [16]. Susan Standing.Gray’s Anatomy. 40thedn. Churchill Livingstone, Elsevier.-2008- p no :992-1003