

11 A STUDY OF BRANCHING PATTERN OF SECONDARY BRONCHI.

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ABSTRACT:

BACKGROUND: Lungs, the pair of respiratory organs are made up of independent functional units called bronchopulmonary segments, each having its own segmental/tertiary bronchus. Not much significant evidence is available for the variations in branching of secondary bronchi.

AIM: The present study was undertaken with an aim to discover the variations in the branching pattern of secondary bronchi of both the lungs.

METHOD: Ten casts – 6 male specimens and 4 female specimens, of tracheobronchial tree prepared from silicone gel using luminal cast plastination method were used for this study. The pattern of division given in Gray's textbook of Anatomy (35th edition) was used as a reference.

RESULTS: The variations were found in 4 out of 10 (40%) specimens on right side and 3 out of 10(30%) specimens on left side. Moreover, in males, 3 out of 6 (50%) on right side and 1 out of 6 on left side (16.67%). In females 25% on right side and 50% on left side varied.

CONCLUSION: Thus the study indicated that the variations in the branching pattern of secondary bronchi occurs on both the sides in both sexes in significant percentages.

LIMITATION of the study: The sample size of this study was too small.

SUGGESTION for further research: It is suggested that the present study should be extrapolated with large sample size.

KEYWORDS: secondary bronchi, tertiary bronchi.

INTRODUCTION :

Human Anatomy is a science of facts about structures and their variations. Dissection is a routine and irreplaceable means to explore this existence. Due to the advancement of technology, newer techniques to unravel the facts are being adopted. The preservative formalin has its own hazards like carcinogenesis, allergic contact dermatitis, rhinitis, conjunctivitis. These side-effects can be reduced by adjuncting the teaching with the specimens produced by other methods which do not have such toxic hazards.

One such method of preparation of the dry, colored, non-toxic, durable, odorless, natural-looking specimens is plastination. Plastination is a new art in science. Luminal cast plastination using silicone gel is one of the methods of plastination to obtain the negative replica or mould of a tubular structure e.g. tracheobronchial tree, arterial -

venous - ductal branches and their variations. The principle involves the filling up of the lumen with the material and dissolving the surrounding tissue.

Lungs, the pair of respiratory organs are made up of independent functional units known as bronchopulmonary segments, each having its own tertiary or segmental bronchus. There are ten segmental bronchi on each side. The spread of infection or carcinoma may be limited to one segment only. An accurate anatomical knowledge of the various parameters – length, transverse and anteroposterior diameters of the various bronchi and sub-carinal is of immense importance in the surgical resection and reconstruction of any part of the lung. These informations have potential applications for studies in pulmonary physiology and anaesthesiology as well as for the conduction of some maneuvers like endotracheal intubations and bronchoscopic procedures (diagnostic, therapeutic and combined) with skill and perfection.

This is used to prepare the tracheobronchial tree casts from lungs along with trachea specimens which were used to study the variations of secondary bronchi.

AIMS and OBJECTIVES:

The aim of the present study was to study the variation in the branching pattern of the secondary bronchi.

Material and Methods:

The present study was carried out after seeking the permission from the Institutional Ethical Committee for Human Research (IECHR), Medical College, Baroda, Gujarat, India.

1. Study design : *Retrospective observational study*

2. Sample size: *It is a feasibility sample and time bound sample. Ten fresh specimens of trachea with intact lungs obtained from the forensic medicine department from the unclaimed bodies. The cold room record shows that on an average there are four unclaimed bodies a month out of which excluding the damaged bodies and other exclusion criteria two specimens can be obtained per month. The procedure for making one cast requires on an average 5 days. Thus considering the period of data collection from April 2013 to November 2013, the sample size is kept to be 10.*

3. Inclusion criteria:

- *Undamaged specimens of trachea with lungs of any age and sex.*
- *Normal spongy texture of lung parenchyma on grossing of specimens.*

4. Exclusion criteria :

- *Tracheostomised patients.*
- *History of respiratory infections before death or lung cancer if available.*
- *Nodules or abnormal consistency of lung parenchyma on grossing.*

MATERIALS USED:

- *Jars for storage and processing,*
- *Fresh human lungs with trachea*
- *Detergent*
- *Hydrogen peroxide*
- *Injecting gun and silicone gel tubes*
- *Dissection instruments, gloves and mask.*
- *Concentrated acid for maceration*

METHOD:

- *A. The method of preparation of luminal cast:*
- *The fresh specimen collected is washed with detergent and hydrogen peroxide till the clean water comes out of the lumen of the trachea. It take over 3-4 hrs of continuous cleaning. The air is passed in the trachea using an air compressor for an hour to remove the water from the lungs which comes out from the pulmonary vessels and lung parenchyma.*
- *The silicone gel is injected into the lumen with the injecting gun till a firm pressure is felt and the resistance to the flow of the silicone into the tracheal lumen.*
- *The filling end is tied with a thread and the specimen is kept in a bucket of water overnight so that equal pressure is distributed over it from all the sides.*
- *The specimen is put in the concentrated acid for maceration for 2-3 days.*
- *Wash the specimen under running water to slough off the remaining tissue. The cast is ready for inspection.*
- *Ten fresh specimens of trachea with lungs were collected, 6 were males and 4 were females, the mean age was 49.6yr for males (41-60 yr) and for females it was 54 yr (41-60 yr).*

OBSERVATION and RESULTS:

- a. A subapical bronchus is found arising just 2mm below the apical bronchus in right inferior lobe bronchus of one specimen out of six male specimens studied.
- b. Medial segmental bronchus arises as an independent stem rather than the common anteromedial stem in right inferior lobe bronchus in three specimens out of total 10 studied. Two out of six male specimens and one out of four female specimens.

c. The posterior and lateral segmental bronchi in lower lobe arise independently from the parent stem rather than the common stem in left lower lobe in two specimens one out of six male specimens and one out of four female specimens.

d. In one specimen out of four female specimens the three segmental bronchi- anterior, apico-posterior and the stem for lingular bronchii arise directly from the upper lobe bronchus at the same level.

The variations were found in 4 out of 10 (40%) specimens on right side and 3 out of 10(30%) specimens on left side. Moreover, in males, 3 out of 6 (50%) on right side and 1 out of 6 on left side (16.67%). In females 25% on right side and 50% on left side varied.

DISCUSSION:

As described by John W. et al in their study on Variant bronchial anatomy- CT appearance and classification, an accessory superior segmental bronchus ⁽¹²⁾ is found in the present study whose photograph is shown with observations. This variation is found on the right side which consists of two closely spaced bronchi that bridge the site of origin of the apical segmental bronchus.⁽¹²⁾ Moreover, Atwell.S.W et al, in their article suggest that most bronchial anomalies are on the right and supernumerary superior segmental bronchus and tracheal bronchus are most common findings.⁽¹⁸⁾

The present study was undertaken as a preliminary project to have a 'hands-on' luminal cast plastination technique. The method was devised for our laboratory setting and a small study conducted on 10 samples which was purely dependant on the availability of the unclaimed specimens at the Forensic Medicine Department.

Hence, a further extensive study with more number of specimens and all age-groups is recommended.

CONCLUSION:

The present study gave a hands-on for luminal casting plastination technique, which is an emerging and evolving art in science.

The casts produced were beautiful, anatomically precise, giving a three-dimensional insight of the branching pattern of the tracheo-bronchial tree.

Moreover, the sexual difference between various parameters is clearly evident and can be demonstrated.

The variation was found in the branching pattern of the secondary bronchus of the lower lobe.

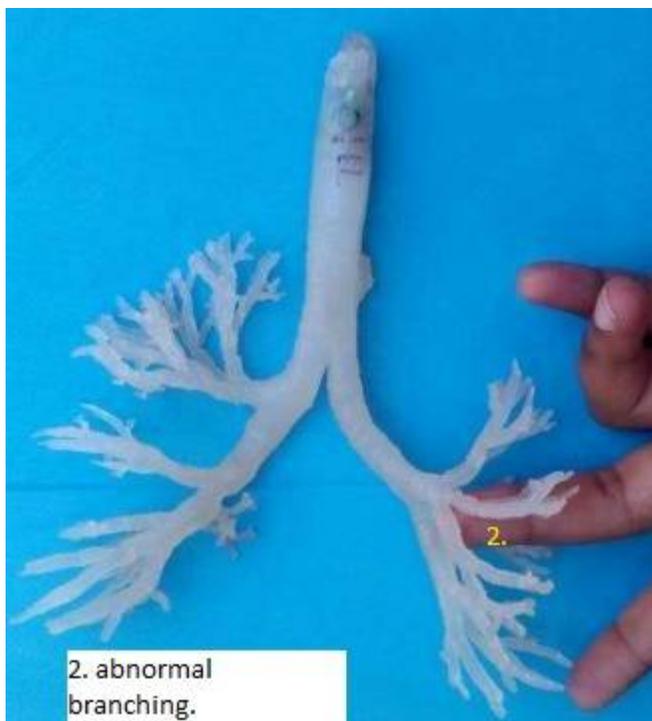
These casts may be used for undergraduate teaching in colleges or for patient-education during pre-surgical counseling.

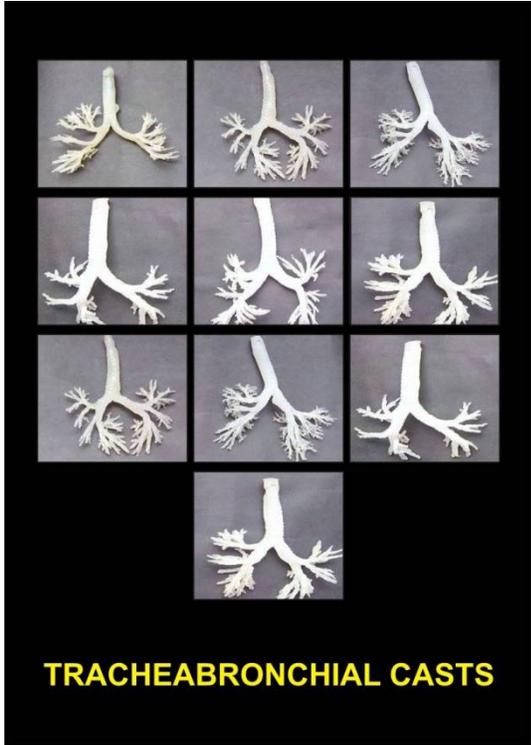
To conclude, the luminal cast plastination proved a good technique to produce the anatomically precise casts which were used for the study of variations.

REFERENCES:

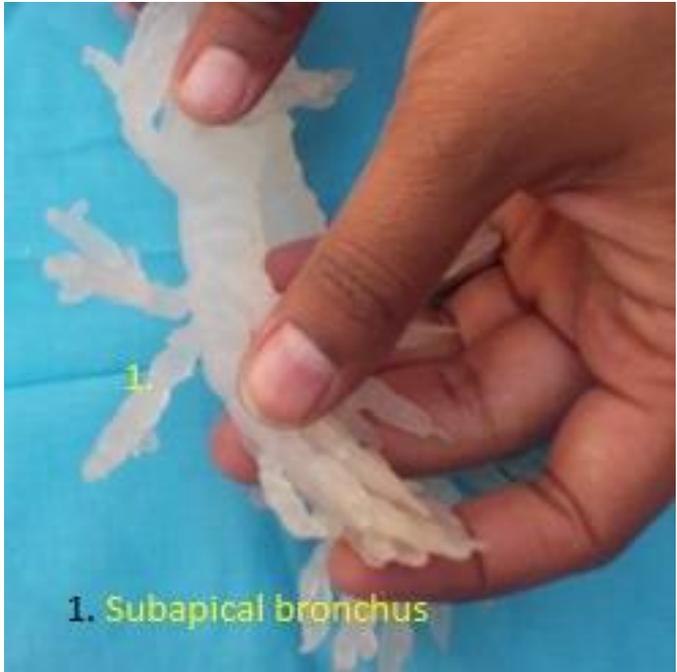
1. Gray's Textbook of Anatomy, 35th edition.
2. Mehta S., Myat H M, The cross-sectional shape and circumference of the human trachea. *Annals of the Royal College of surgeons of England*, (1984) ; 66 : 356-358.
3. Carroll RG: Evaluation of tracheal tube cuff designs. *Critical Care Medicine*, (1973); 1: 153.
4. Chaurasia. B. D 5th Edition, (2010) Textbook of Human Anatomy.
5. Chunder R., Nandi. S, Guha R, Satyanarayan N. A morphometric study of human trachea and principal bronchi in different age groups in both the sexes and it's clinical implications. *Nepal Medical College Journal*; (2010) ;12(4) : 207-214.
6. Haskin PH, Goodman LA. Normal Tracheal bifurcation angle: A Reassessment. *American J Radiology*; (1982) ; 139 : 879-82.
7. Begum T, Naushaba H, Alam J. Cadaveric length of trachea in Bangladeshi adult male, *Bangladesh Journal of Anatomy* (2009) ; 17(1): 42-44
8. Mrudula C., Krishnaiah M., The study of the bronchial tree, *International journal of Pharma and Biosciences* (2011) ; 2(1).
9. Robinson C L, Muller N L, Essery C, Clinical significance and measurement of the length of the right main bronchus, *Canadian Journal of Surgery*.32(1); (1989) : 27-28.
10. Sathidevi V.K. et al , *Journal of Anatomical Society of India* (2002).
11. Kim D, Son JS, Measurements of the length and diameter of the main bronchi on the three-dimensional images in asian adult patients in comparison with the height of patients. *Journal of Cardiothoracic Vascular Anaesthesiology*. (2013) (ahead of print).
12. John W. Wu, Charles S. White, Christopher A. Meyer. Variant bronchial anatomy-CT appearance and classification. *American Journal of Radiology*. (1999) ; 172: 741-74.
13. Seneterre E, Paganin F., Measurement of the internal size of bronchi using high resolution computed tomography (HCRT), *European Respiratory Journal*, (1994) ; 7: 596-600.

14. Robert W.Henry. Silicone tracheobronchial casts *Journal of international society of Plastination.* (1992) ; 6 : 38-40.
15. Aultman. A., Blythe J., Showder H. Enhancing the value of organ silicone casts in human gross anatomy education. *Journal of the International Society of Plastination.* (2003) ;18 : 9-13.
16. Arora. J, Kapur. V, Kakkar. A , Dixit. P.C. Ramification pattern of portal vein in right lobe of liver- a corrosion cast study. *Journal of the Anatomical Society of India,* (2003); 52(1) : 12-14.
17. NATCON-60, National Conference for Anatomists.
18. Atwell S. W. Major anomalies of the tracheobronchial tree with a list of minor anomalies. *Diseases of Chest.* (1967) ; 52 :611-615.





TRACHEABRONCHIAL CASTS



1. Subapical bronchus