

A Study of Tracheobronchial Tree Using Luminal Cast Plastination

Dr. Diana Laishram* Dr. Sathvika T**

*Assistant Professor, Department Of Anatomy, Jagannath Gupta Institute Of Medical Science And Hospital,
Budge Budge

**Senior Lecturer, Department of Anatomy, JKKN Dental College, KPM, Tamilnadu.

Abstract: Fresh and well preserved specimens are a must in anatomy teaching. Plastination has emerged as a ray of hope for near ideal preservation of biological specimens. The study was conducted using fresh specimen of trachea and lungs of sheep obtained from the slaughter house to study the tracheobronchial tree using luminal plastination. On examination the plastinated specimen of sheep tracheobronchial tree shows trachea with its cartilaginous markings, division of trachea into principle bronchi, lobar bronchi, segmental bronchi upto the alveoli. The plastinated specimen was near ideal and are excellent for teaching gross anatomy, neuroanatomy and radiology. Hence, these specimens can be used as a better teaching aid in schools, colleges and research institutes.

Keywords: Plastination, Luminal cast, Tracheobronchial tree

I. Introduction

Fresh and well preserved specimens are a must in anatomy teaching. With the worldwide dearth of cadaver donations, availability of fresh specimens is drastically reducing. In view of this scarcity of organs and tissues for studies, teaching and research, newer techniques preserving the biological tissues for long duration was necessitated. Plastination has emerged as a ray of hope for near ideal preservation of biological specimens. It is a technique of preparation of dry, coloured, non-toxic, durable, odourless and natural looking specimen of whole body/ organs, tubular structures and organ cavities. The method was first invented by Gunther Von Hagens in Heidelberg, Germany in 1978. He imagined as to what would happen if plastic was impregnated into substances.¹ After receiving patents from US government, Hagens established Institute for Plastination in 1993 and displayed the first exhibition of plastinated bodies, "Body World" at Japan in 1995 which drew over three million people.²

There are three methods of plastination namely whole organ/ body plastination, sheet plastination and luminal cast plastination.

1. Whole organ/ body plastination- By this technique any part of body or whole body can be preserved for the purpose of understanding of total structure.
2. Sheet plastination- By sheet plastination thin transparent or thick opaque body sections are prepared and can be compared with C.T. scan and M.R.I plates.
3. Luminal cast plastination- By this technique specimen of tubular structures such as blood vessels, ducts, tracheobronchial tree and cavities of the body can be prepared.

The principle involves filling up of the lumens with rubber silicone and removing the surrounding tissue by boiling.^{3,4}

Though it is difficult and time consuming, it is the most promising and stable method to preserve the specimens as an alternative to formalin preservation.^{2,5} However, it appears that many anatomists have not yet realized the revolutionary significance of plastination for anatomical research.²

II. Materials And Methods

Materials required-

1. Fresh specimen of sheep lung
2. Silicon gel tube with its cannula
3. Forceps
4. Plastic tubes
5. Syringes
6. Thread



Fig-1 Silicon Gel Tube With Silicon Gun



Fig-2 Plastinated Specimen Mounted In a Glass Jar

Methods- A fresh specimen of trachea and lungs of sheep was obtained from the slaughter house. The tracheobronchial tree is cleaned repeatedly in continuous running water until all the blood is drained out of the lungs. The excess water from the lumen is removed and lungs were gently pressed to remove excess water from the tracheobronchial tree. A readymade rubber silicon gel was injected slowly into the lumen of trachea using a silicon gun until it fills the entire tracheobronchial tree. The open end of trachea is tied and left to dry until the sealant solidified. The surrounding lung tissue is destroyed by boiling for about an hour leaving behind the luminal cast of tracheobronchial tree. The plastinated luminal cast is then cleaned and mounted in a glass jar.

III. Observations

The plastinated specimen of sheep tracheobronchial tree shows trachea with its cartilaginous markings, division of trachea into principle bronchi, lobar bronchi, segmental bronchi upto the alveoli.

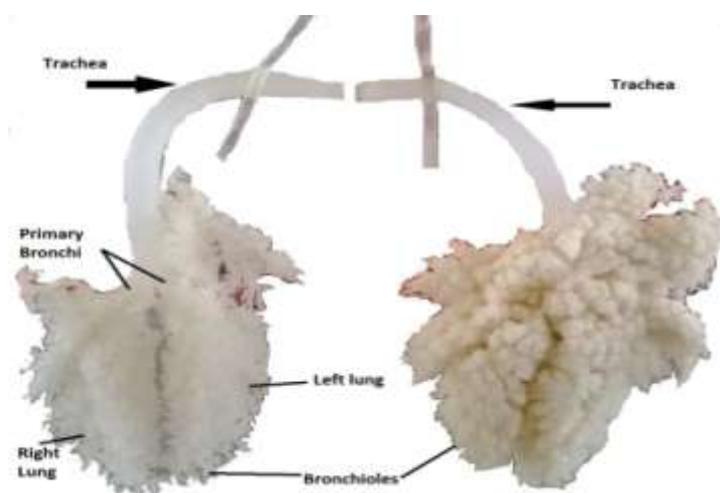


Fig-3 Plastinated Specimen of Sheep Lungs

IV. Discussion

Anatomical study requires long-lasting preservation of the cadaver. Arterial embalming has been used since the 17th century and allows a three-dimensional study of the human body. Due to the shortage of cadavers, specimens need to be preserved for a longer duration while retaining its natural and realistic appearance.

Plastination is increasingly finding applications in the varying fields. The plastinated specimens are near ideal and are excellent for teaching gross anatomy, neuroanatomy (where routine specimens are delicate and sparse). Silicon casts of ventricular system of brain and tracheobronchial tree can be utilized for teaching. The anatomical structure and relations are well preserved and appear like fresh specimen.⁶

A silicon tracheobronchial casts of cat, dog, horse, pig and ox was prepared using 5 different polymers of varying viscosity and was found that-

1. Polymers low in viscosity flow into the alveoli and fills nearly the entire volume of the lung, whereas more viscous polymers present a more clear view of the branching pattern of the bronchi as less polymer enters the distal airway.
2. The tracheas with the galvanized stiff wire insert were better suited to support the airways in a horizontal position.
3. Casts prepared by using 100% silicon rubber product are more promising in terms of costs as well as quality.⁷

A coloured silicon casts of human heart, tracheobronchial tree and brain ventricles were prepared from unembalmed cadaver. It was concluded that the casts were of excellent quality in terms of flexibility, clarity of details and anatomical accuracy. These casts provide a visual representation of internal architecture of each organ.⁸

A comparative study was carried out using formalin fixed specimen in control group and plastinated specimens in experimental group as a teaching aid. The knowledge base of control and experimental group before and after use of fixed and plastinated resources were examined. It was found that, all the plastinated resources available were heavily used and deemed useful by students. Also, it was concluded that traditional material should be used in conjunction with plastinated resources.⁹

Plastinated specimens can be used for both light microscopy and ultrastructural studies after deplastination with sodium methoxide.¹⁰

Exhumed mummies, rare animals or archaeological materials can be plastinated for museum display. The technique can preserve tissue sample to be used as medicolegal evidence. Though the plastinated specimens are of high quality, they lack the feel and texture that is provided by wet cadavers. In the present study, a luminal cast of tracheobronchial tree of sheep is prepared using silicon gel. The cast showed trachea and its divisions, subdivision up to alveoli. The cast enables the student to see and feel the three dimensional architecture of tracheobronchial tree which is difficult to understand by two dimensional figures. The specimens of normal lung, lung tissue with anomalies, angulations, tubular organs like blood vessels, ducts and cavities like ventricles of brain can be prepared with ease by using silicon gel luminal cast technique.

Ethical issues- Body art exhibitions raised an ethical debate about display of human specimens. Only education display is thought to be logical, while hidden aspects (e.g. art, entertainment, showmanship, personal and professional self-actualization reaping financial rewards) of plastination are being questioned.¹² Churches and religious groups protest believing that whole body plastinates are against the laws of nature and disrespect death.¹³

V. Conclusion

The plastinated specimens are near ideal and are excellent for teaching gross anatomy, neuroanatomy and radiology. Though it is difficult and time consuming, it is the most promising and stable method to preserve the specimens as an alternative to formalin preservation. These specimens can be used as a better teaching aid in schools, colleges and research institutes.

References

- [1]. KCN, Priya K, Lama S And Magar A. Plastination An Unrevealed Art In The Medical Science. KMC Student KUMJ. 2007; 5: 139-141.
- [2]. Pashaei S. A Brief Review On The History, Methods And Applications Of Plastination. Int. J. Morphol. 2010; 28(4); 1075-1079.
- [3]. Shamasundar N. M. Low Cost Plastination Technique For Developing Countries. Journal Of International Society Of Plastination. 1996;11: 8-13.
- [4]. Shamasundar N. M. Launch Your Own Plastination Lab. The Indigenous Way. Journal Of Anatomical Society Of India. 1996; 127: 156.
- [5]. Dawson T.P, James R.S, Williams G.T. How Do We Teach Pathology? Silicone Plastinated Pathology Specimens And Their Teaching Potential. Journal Of Pathology. 1990; 162: 265-272.
- [6]. Henry R.W. Polyester Plastination Techniques, Specific Troubles And Problems. Murcia, Spain, 12th International Conference On Plastination. 2004.
- [7]. Henry W.R. Silicone Tracheobronchial Cast. Journal Of International Society Of Plastination. 1992; 6: 38-40.
- [8]. Aultman. A. Et Al. Enhancing The Value Of Organ Silicon Casts In Human Gross Anatomy Education. Journal Of International

- Society Of Plastination. 2003; 18: 9-13.
- [9]. Rafel M. Et Al. How Useful Is Plastination In Learning Anatomy? *Journal Of Veterinary Medical Education*. 2007; 34(2): 172-176.
- [10]. Grodin G, Grodin G.G, Talbot B.G. A Study Of Criteria Permitting The Use Of Plastinated Specimens For Light And Electron microscopy. *Biotech. Histochem*. 1994; 69(4): 219-234.
- [11]. Ravi S.B And Bhatt V.M. Plastination : A Novel Innovative Teaching Adjunct In Oral Pathology. *Journal Of Oral Maxillofacial Pathology*. 2011; 15(2): 133-137.
- [12]. Myser C. Taking Public Education Seriously. *BODY WORLDS, The Science Museum, And Democratizing Bioethics Education. Am. J. Bioeth*. 2007 ; 7: 34-36.
- [13]. Jones D.G And Whitaker M.I. Engaging With Plastination And Body Worlds Phenomenon. A Cultural And Intellectual Challenge For Anatomists. *Clinical Anatomy*. 2009; 22: 770-776.