



## EMBALMING – AN OVERVIEW

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### ABSTRACT

Background: Embalming, one of the mankind's longest practised arts, is a means of artificially preserving the dead human body. Embalming is an unavoidable necessity of the modern society. It has been in practice since ancient times. Everybody is made up of complex system of mechanics, and that of man is rather more complex. It is essential for the embalmer to have a sound understanding of the internal anatomy of the body which permits the embalmer to make appropriate skin incisions and anticipate the structures which will appear when the incision is made.

**Keywords:** Embalming, Formaldehyde, funeral

### INTRODUCTION

Embalming is the art and science of preserving human remains by treating them (in its modern form with chemicals) to forestall decomposition. The intention is usually to make the deceased suitable for public or private viewing as part of the funeral ceremony, or keep them preserved for medical purposes in an anatomical laboratory. The three goals of embalming are sanitization, presentation, and preservation, with restoration being an important additional factor.

**HISTORY:** The ancient culture that developed embalming to the greatest extent was Egypt. As early as the First Dynasty (3200 BC), specialized priests were in charge of embalming and mummification. They did so by removing organs, ridding the body of moisture, and covering the body with natron<sup>[1]</sup>. Other cultures known to have used embalming techniques in antiquity include the Meroites, Guanches, Peruvians, Jivaro Indians, Aztecs, Toltecs, Mayans, and Tibetan and southern Nigerian tribes. The earliest known evidence of artificial preservation in Europe was found in Osorno (Spain). In China,

artificially preserved remains have been recovered from the period of the Han dynasty (206 BC – 220 AD). The period of the Middle Ages and the Renaissance is known as the anatomists' period of embalming and is characterized by an increased influence of scientific developments in medicine and the need for bodies for dissection purposes. Early methods used are documented by contemporary physicians such as Peter Forestus (1522–1597) and Ambroise Pare (1510-1590). The first attempts to inject the vascular system were made by Alessandra Giliani, Leonardo da Vinci (1452-1519), Jacobus Berengar (1470–1550), Bartholomeo Eustachius (1520–1574), Reinier de Graaf (1641–1673), Jan Swammerdam (1637–1680), and Frederik Ruysch (1638–1731)<sup>[2]</sup>. Modern embalming for mere funeral purposes is believed to have begun in 1861 in the American Civil War, mainly due to sentimental motives. Within the framework of (undergraduate) medical education, anatomists use human bodies to teach students, either by demonstrating prosected specimens or by dissection done by the students themselves. The bodies are therefore used as

educational tools. Here, the first priority is for long-term preservation, not presentation. As such, medical embalmers use anatomical wetting fluids that contain concentrated formaldehyde (37–40%, known as formalin) or glutaraldehyde and phenol, and are made without dyes or perfumes. Many embalming chemical companies make specialized anatomical embalming fluids. Anatomical embalming is performed into a closed circulatory system. The fluid is usually injected with an embalming machine into an artery under high pressure and flow, and allowed to swell and saturate the tissues.

**DISCUSSION:** Human embalming started in Egypt. The ancient Egyptians raised the process of embalming to a fine art in the production of their mummies. Initially human embalming was carried out mainly in medical colleges in the western world before extending to other parts of the world. In 1832 and 1871, the anatomy acts passed into law permitted dead bodies to be embalmed and then dissected for the purpose of teaching students of medicine, dentistry, physiotherapy, Medical Laboratory sciences and for anatomical research <sup>[3]</sup>. Today human embalming is also employed so that a body can be transported long distance and funeral rites can be conducted with due measures. Embalming also restores the body to an acceptable physical appearance for viewing following a traumatic death or devastating illness.

### Means of preservation:

**Natural means of preservation:** include freezing, desiccation/exsiccation either by dry cold or by dry heat, and the nature of the soil.

**Artificial means of preservation:** comprise of the application of simple heat or cold, powders, such as a sawdust bed mixed with zinc sulphate, evisceration combined with immersion, drying, local incision and immersion, arterial injections, cavity injections, simple immersion in alcohol, brine, and sole arterial injection, which can be combined with cavity treatment and/or immersion.

**Modern anatomical preservation:** Prior to the introduction of carbolic acid, or phenol, and later of formaldehyde, the main preserving agents used in anatomies were alcoholic solutions of arsenic and/or alumina salts in different concentrations. Phenol was introduced to anatomical embalming by Laskowski

(1886) in the mid-19th century. He initially used a mixture of phenol and glycerine as vehicle (one part phenol, 20 parts glycerine); later on he replaced parts of the glycerine with alcohol (one part phenol, one part boric acid, four parts alcohol, 20 parts glycerine) <sup>[2]</sup>. Discovery of formaldehyde by the German chemist August Wilhelm von Hofmann in 1869 (Hess, 1901) proved to be an excellent preservative (Trillat, 1892; Blum, 1893, 1894, 1896; Gerota, 1896) and became the foundation for modern methods of embalming (Ezugworie et al. 2009). The acute toxic effects of formaldehyde and its ability to induce contact dermatitis are beyond doubt. Animal studies do not provide conclusive evidence for carcinogenic potential of formaldehyde, but it cannot be excluded <sup>[4]</sup>. Recently, Hammer et al. (2012) described a formaldehyde-free system which comprises ethanol (0.7 L kg<sup>-1</sup> body weight), glycerine (5%) and thymol. The ethanol–glycerine fluid is injected arterially; afterwards the bodies are immersed in ethanol (65%). A thymol-ethanol solution (thymol 30.044 g L<sup>-1</sup>; 10% ethanol in aqueous solution) as moistening solution is used for keeping the state of fixation at room temperature. Polyhexamethyleneguanidine hydrochloride was used as embalming agent and was compared with the efficiency of formalin fixation by Anichkov et al. (2010, 2011). Al-Hayani et al. (2011; Bedir, 2009), suggested the use of shellac, a complex mixture of aliphatic and alicyclic hydroxyl acids and their polyesters, derived from the hardened secretion of the lac insect(s).

**Arterial embalming:** consists of injection of an embalming fluid into the arterial system of the cadaver and utilizing the whole vascular system. Injection of embalming chemicals into the blood vessels, usually via the right common carotid artery or via the femoral artery is done and blood is displaced from the right jugular vein. The embalming solution is injected by a mechanical pump and the embalmer massages the corpse to ensure a proper distribution of embalming fluid.

**Cavity Embalming:** The internal fluid of the corpse is suctioned; thereafter, an injection of embalming chemicals into the body cavities using an aspirator and trocar is done. The embalmer makes a small incision just above the navel and pushes the trocar in the chest and stomach cavities to puncture the hollow organs and aspirate their contents. The cavity is then

filled up with concentrated chemicals that contain formaldehyde. The incision is either sutured or a "trocar button" is screwed into place <sup>[5]</sup>.

**Hypodermic Embalming:** This involves injecting the embalming chemical under the skin as needed <sup>[6]</sup>.

**Surface embalming:** This supplements the other methods especially visible injured body parts <sup>[1]</sup>.

**Specialist Embalming:** Decomposed bodies, trauma cases, frozen and drowned bodies and those to be transported for long distances also require special treatment beyond that for the "normal" case. The recreation of bodies and features damaged by accident or disease is commonly called restorative art or demisurgery. A six-point injection is made through the femoral arteries, axillary vessels and common carotids with the viscera treated separately with cavity fluid in a viscera bag.

**Cryopreservation:** is another technique of preserving human dead. The body is preserved by cooling to low sub-zero temperatures. At these low temperatures, any biological activity, including the biochemical reactions is effectively stopped.

**Plastination:** Plastination is a technique used in anatomy to preserve bodies or body parts, first developed by Gunther von Hagens in 1977. The water and fat are replaced by certain plastics, yielding specimens that can be touched, do not smell or decay, and even retain most properties of the original sample. There are four steps in the standard process of plastination: fixation, dehydration, forced impregnation in a vacuum, and hardening. Water and lipid tissues are replaced by curable polymers. Curable polymers used by plastination include silicone, epoxy and polyester-copolymer <sup>[7]</sup>.

**Thiel's embalming:** Using a process developed over several decades, the so-called Thiel's soft-fix embalming method, retains the body's natural look. Skin and muscles remain flexible, allowing the limbs to be moved, while the body's internal organs are clearly identifiable and respond to the surgeon's scalpel as if alive <sup>[8]</sup>.

**Embalming Chemicals:** Embalming chemicals are a variety of preservatives, sanitizing, disinfecting agents and additives used in modern embalming to temporarily prevent decomposition and restore a natural appearance for viewing a body after death.

Embalming fluids acts to "fix" (technically denature) cellular proteins which means they cannot act as a food source for bacteria and it also kills the bacteria themselves <sup>[9]</sup>.

**Constituents of Embalming Fluids:** In the gravity tank 1 gallon of isopropyl alcohol. 2 gallons of propylene glycol. ¼ gallon of amphyl ½ gallon of 10% buffered formalin. 500 litres of liquefied phenol are used. After the fluid is added, the gravity tank is filled with water to reach the tank capacity of ten gallons.

**Embalming apparatus:** The basic apparatus that are normally used for embalming are:

Anatomical bottle [aspirator bottle] plastic type preferable, Scalpel blade [surgical blade], Hand gloves, Laboratory coat, Rubber boots or shoe covers, embalming room.

Precautions to be observed while embalming: (1) Do not eat or drink where embalming is being carried out. (2) Do not allow the embalming fluid to come in contact with your skin, body, mouth or eyes, and if it does accidentally, wash the affected part thoroughly with water. (3) Always wear laboratory clothing like hand [surgical] gloves, laboratory coat, and rubber boots. (4) Tidy up the corpse with disinfectants before embalming commences. (5) Make sure that the correct instruments are used as these make it simple and easier. (6) for health reasons, it is always advisable to embalm bodies in areas where there is ventilation. (7) Always wear mask. (8) Wash and sterilize embalming instruments after use. (9) Wash your hands very well <sup>[10]</sup>.

**CONCLUSION:** Embalming is the process of chemically treating the dead human body to reduce the presence and growth of microorganisms, in order to retard organic decomposition and restore acceptable physical appearance. Modern embalming techniques are the result of accumulation of errors, trials and inventions, and varied according to different cultures and people, which was modified from time to time after discovery in the field of medicine. With the advancement of technology, new embalming techniques were developed and modified, with the main objective of retarding decomposition and maintaining excellent presentation. Embalming fluid which fixes cellular proteins and kills bacteria and fungus is mixtures of different chemicals that

restores the body to acceptable physical appearance and have being modified according to need. Despite the advantages and disadvantages of various embalming techniques, the modern techniques have proven to be more effective than the ancient ones as they can keep a body intact for decades without decomposing it by autolysis and putrefaction.

## REFERENCES:

1. "Encyclopedia Smithsonian: Egyptian Mummies". *www.si.edu*. Retrieved 2 February 2017.
2. "Human body preservation - old and new techniques". *Brenner, Erich (January 2014). Journal of Anatomy. 224(3): 316–344.*
3. Mayer and Robert, G. (1990). History, Theory and Practice of Human embalming. Appleton and Lange.
4. Ikeda A, Fujimoto K, Yoshii I, Matsumoto S, Nishitani K, Ikeda K. [Arterial embalming method of the cadaver and its application to research]. *Kaibogaku Zasshi* 1993; 68(4): 410- 421.
5. Quigley, Christine (17 September 2015). *The Corpse: A History*. McFarland. ISBN 9781476613772.
6. Batra A.P.S, Khurana B.S, Mahajan A, Seema, and Kaur N (2010). Embalming and other methods of dead body preservation. *International Journal of Medical Toxicology and Legal Medicine* 12: 3.
7. Ravi S.B and Bhat V.M (2011). Plastination: A novel innovative teaching adjunct in oral pathology. *Journal of Oral and Maxillofacial Pathology* 15 (2): 133-137
8. Eisma R, Lamb C, and Soames R.W (2013). From Formalin to Thiel Embalming: What Changes? *One Anatomy Department's Experiences. Clinical Anatomy* 26:564–571.
9. Human Embalming Techniques: A Review- Ajileye, Ayodeji Blessing Esan, Ebenezer Olubunmi Adeyemi, Oluwakemi
10. *Am. J. Biomed. Sci.* 2018, 10 (2), 82-95; doi: 10.5099/aj180200082 © 2018 by NWPII.