DOI: https:/doi.org/10.56981/P0000126

"Intl. J. P. Sci., vol. 01 no. 2, pp. 30-36" Ineternational Journal of Pure Sciences ISSN:2961-3159

"THE HISTORY OF EMBALMING"

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(Received 16 May 2022, Revised 7 July 2022, Accepted 01 August 2022)

ABSTRACT

Embalming is one of the widely known traditional methods to preserve corpses by slowing down the process of decomposition. Scientists preserve the dead body by sterilizing it with different chemicals. The main purpose of this paper is to provide a review of the articles that centers the mode of discussion on the history of Embalming. The history of Embalming has been presented in the paper, and references from other articles have elaborated on various information. The purpose of Embalming has been mentioned in the paper, along with the importance indicated. The paper has also commented upon the ways of Embalming and the chemicals needed to sterilize a body. Plastination is one of the well-known techniques that has also been known to mummify a body but definitely with a better consequence. The paper has also reviewed the information on the plastination technique, and in order to support the aspect, reference from other research has also been taken into consideration.

Keywords:- embalming, plastination, preservation

Citation:
Raed H.Ogaili, Lames H. Amanseekanaa, Sneha Roy Chowdhury**,** Nisreen Jawad Kadhim**.** The history of embalming. *Intl. J. P. Sci. 2022;01(2): 30-36. https:/doi.org/10.56981/P0000126*

INTRODUCTION

The history of Embalming will be the main topic of discussion in this paper. The traditional methods known as mummification will be elaborated on in the paper. The paper will review the primary article taken for reference to discuss the history and importance of Embalming. The paper will also consider aspects of other articles to support the aspect presented by the article. Plastination will also be the main topic of discussion as it is one of the advanced methods of Embalming. The importance of Plastination and the techniques that are used to preserve and sterilize dead bodies will be discussed in the paper.

DISCUSSION

One of the traditional methods of preserving dead bodies is known as Embalming. The procedure includes certain medical ongoings to sterilize it to avoid decay. This has been one of the practical and theological reasons to practice since the days of ancient Greeks as they demanded to make the dead bodies last longer until the completion of the final rites. The corpses were preserved in a mixture of vinegar, wine and other spirits that tend to be much stronger. The procedure is traditionally considered a part of science and art. "The treatment of the dead body with aqueous solutions of soluble germicidal and preservative chemicals by vascular and a cavity injection to prevent putrefaction is called embalming" [1]. The article states that the process of Embalming is the chemical treatment of the dead human body which can reduce the presence of “micro-organisms” to delay the decay process and restore the original physical appearance by making it acceptable. By the procedure of Embalming, it has been known that it helps to coagulate the tissue proteins that get hardened. The article by Batra *et al*. (2010) has laid the main discussion on the topic of Embalming in which they have elaborated on the fact how the procedure of Embalming. Three possible ways have been elaborated that can be the reason for the Embalming of the dead bodies. The primary reason can be preserving the dead bodies in the medical college for practical study. The secondary reason is when the body has to be migrated from one place to another for burial or cremation. The third reason can be the preservation of famous or significant personalities to showcase to the public. The fact can be supported by some researchers who have mentioned that the reason for Embalming is to generate the growth of the micro-organisms by reducing the risks of infection and avoiding the decomposition of the cadaver [2].

Figure (1) Stages of embalming process,

The paper mentions the history of the embalming procedure since ancient Egypt before 4000 BC, and the Egyptians have used it for over 30 centuries. Mummification or Embalming was influenced by the Egyptians first (figure No.1) . According to the aspect of Sluglett, “In the popular mind, the practice of mummification is usually associated solely with ancient Egypt, yet there is a good deal of evidence that it has also been customary in other parts of the world as far away as Peru and the Canary Islands” [3]. The term mummy has been derived from the place Egypt which generally refers to the Embalming of the dead body or desiccation of a human or an animal body by exposing it to the sun and the air.

The steps of mummification discussed in the primary article include – "the brain and the internal organs of the bodies being removed and kept in Canopic jars". The heart of the body was left inside as the ancient people of Egypt believed that the heart is the controller of all thoughts, memories and intelligence. Finally, the body was covered in a salty substance, and it is named Natron which was left to dry for about 40 days [1]. In order to reduce the limp and lifeless appearance of the body, it was covered in sawdust. After this process, the body is bathed finely in wine and spices, wrapped with linen clothes, and left out for more than 30 days to dry. After the bodies were mummified, they were kept in a mummy case, placed in a coffin jar and then in "asarcophagus". These procedures were followed to mummify or embalm a dead body. After observation, it has been found that the mummification procedure includes different materials to complete the process. The materials include Natron Salt, Coniferous resin (includes pine oil, cedar wood resin, and juniper), Mastic (natural resin that is extracted from the trunk of mastic trees), Beeswax and Bitumen [4]. The names of some of the famous personalities that were embalmed have been enlisted in the primary article. It includes the name of the Late British Royal Princess Diana and the name of Abraham Lincoln. These were a significant part of traditional embalming methods, but nowadays, the procedure has been improvised into modern Embalming. Centuries and decades of research have given birth to modern Embalming. The actual procedure of Embalming generally includes four processes – "Arterial Embalming, Cavity Embalming, Hypodermic Embalming and Surface embalming" [1]. Embalming generally consists of natural and non-natural methods. The mummification process is considered one of the most effective natural embalming methods. The practitioners have also conducted intensive research and developed different artificial embalming methods to preserve dead bodies. Artificial methods include Opening the Femoral Artery, Perfusion, Specialist Embalming, and Plastination [5]. The procedure of Plastination is one of the most effective ways to preserve a dead body that is being practiced nowadays. Plastination is one of the embalming techniques used in anatomy to preserve the parts of the body, and it was developed first in the year 1977. The water and the fat of the body are replaced by specific plastics, yielding specimens that are touchable, do not have any smell, or it does not decay and retains the majority of the part of the original sample [5]. The process of Plastination generally includes four procedures – "fixation, dehydration, forced impregnation in a vacuum, and hardening". Curable polymers are used to replace water and lipid tissues. Curable polymers that are used in the process of Plastination include "silicone, epoxy and polyester-copolymer". Fixation is the primary step of Plastination in which frequent usage of the formaldehyde solution is needed for two functions. Desiccation of the specimen to display the particular anatomic elements can be much more time taking. The presence of formaldehyde or any other embalming solutions can be used to avoid the decay of the tissues. This can be advantageous as it can assist in maintaining the shape of the specimen. After the procedure of the dissection has taken place, then the dead body is immersed in a solution of acetone [5]. Under the condition of freezing, the acetone helps to withdraw all of the liquid or water from the cells. Next, the body is placed in a solution of "liquid polymer, including silicone rubber, polyester and epoxy resin". A vacuum is created, and the liquid of acetone is kept for boiling at a lower temperature. As the acetone solution is evaporated from the cells, it withdraws the liquid polymer and leaves the cell filled with liquid plastic. In order to harden the gas, the plastic must be cured with gas, heat or ultraviolet light [5]. There has been the presence of other

plastination methods, including the traditional one, which is known as mummification. It was done by the Egyptians by exposing the body to the sun for long hours. The practitioners of Plastination have mentioned that there have been the following steps – "fixation, dehydration, forced impregnation in a vacuum and hardening" [6]. After the introduction of Plastination in medical sciences, it has been applied in the department of anatomy, pathology, forensic sciences and biology all over the world. by making an application of Plastination, different types of experiences have been accumulated. The application of the method of Plastination has been exposed in different areas, including teaching and exposition purposes. The basic knowledge of the application of the technique of Plastination has been mentioned in the paper. The procedure of Plastination includes mainly four variations that produce different types of specimens. The specimen that is impregnated with silicone or silicon-impregnated specimen is generally resilient and flexible and is much more beneficial when it is used in teaching. Specimens that are produced with the help of polymerizing emulsions are not transparent as the specimens of silicone, but they are rigid and are most probably breakable. This technique is used in thicker slices of the body, which exhibits a superb contrast within the fat tissue and displays white and other intensive parenchymas. The transparent body or the slices of the organs are produced within epoxy resins. These epoxy resins are utilized for research purposes in the body. The opaque slices of the brain are impregnated with the assistance of polyester resin which allows uncommon discrimination within the fiber and nuclear areas [6]. The use of plastinated sheet specimens is of much importance when it comes to the teaching of medical sciences. Researchers have used Polyester P45 Plastinated Sheet Specimens while teaching subjects like Anatomy, Pathology and Radiology. The study was conducted in one of the laboratories in China for about one month for the purpose of preparing P45 Plastinated Sheet Specimens. The Plastinated sheets were used practically among 120 students from the region of Karbala in Iraq. The plastinated sheets displayed positive results as it was much more portable and the majority of the students provided a positive response on the assessment of the plastinated sheets. It has been found that, comparing the above studies, the plastinated sheets have shown more positive results in Anatomy than other subjects. More or less, the practical application of the plastinated sheets has shown positive results in all of the subjects above. Materials that have been used to make the plastinated sheets and the methods that have been implied are elaborated on in the article by the researchers that have shown positive results [7].

Now while embalming the dead bodies, there is a certain necessity for using different chemicals. Primarily in the process, preservatives are used and depending upon the preservatives, the bacteria thrive. This process works by reducing the process of decay in the body by changing the enzymes and lysins of the body. The preservative is made with the help of formaldehyde, glutaraldehyde and phenol. Germicides are also used for embalming a dead body, including ingredients like "quaternary ammonium compounds (Roccal, Zephiran Chloride) and glutaraldehyde." The modifying agents are also one of the important ingredients of embalming chemicals, which include buffers, humectants and inorganic salts. These are the ingredients that trigger a chemical reaction that is produced by the preservative solution and function in the embalming fluids in order to control the action of the main preservative agents. The buffers are a significant ingredient that helps to maintain the balance of acid-base, including Borax, Sodium Phosphate, Citrates and Sodium Salt of Ethylene diamine tetra acetic acid. The inorganic salts are the one that

determines the osmotic features of the solution for Embalming. The humectants are used for hydrating the tissues like "Glycerol (Glycerine), Sorbitol, Glycol (Ethylene and Propylene glycol) and Lanolin." "Anticoagulants retard the natural post-mortem tendency of blood to become much more viscous, which includes chemicals like sodium citrate, sodium oxalate and sodium salt of EDTA" [1]. "The surfactants are the type of chemical ingredients that helps to low down the molecular cohesion of the liquid so that it is able to flow through smaller apertures including Sulfonates." "Dyes impart a definite color to the solution for the purpose of embalming, including Eosin, Ponceau Red, Erythrosine and Amaranth." The perfuming agents are also used in order to reduce the harshness of the chemical solution and include Benzaldehyde, Oil of cloves, Oil of Sassafras, and Methyl Salicylate. Embalming of dead bodies has been widely known since ancient times, and salt is one of the most important ingredients that is used in the process of Embalming. The Egyptians are widely known for embalming dead bodies successfully. It has been known from certain chapters of history how much the process of Embalming is important [8]. "Joseph commanded his servants the physicians to embalm his father: and the physicians embalmed Israel. And forty days were fulfilled for him: for so are fulfilled the days of those which are embalmed: and the Egyptians mourned for him three score and ten days…". Herodotus is one of the greatest Greek historians and is one of the well-known examples of Egyptian Embalming. As Carter, in the year 1925, after conducting an examination on the mummy of Tutankhamen said, "Mr. Lucas examined some whitish spots on the skin… and these proved to be composed of 'common salt with a small admixture of sodium sulfate' in all probability derived from the Natron used in the embalming process" [9]. This is quite evident from the above discussion that the use of salt is very important in the process of Embalming. The purpose of Embalming has been one of the common discussions in relevant articles. Firstly, it can be said that the purpose of Embalming is to temporarily preserve the remains of humans to slow down the process of decomposition and make them presentable at the funeral. Secondly, Embalming is used for the purpose of anatomical study and research purposes. "The corpses are often fixed so that they be utilized for the purpose of anatomical dissection and research for the vascular system by using vasography, kinematics of the joint and other histologic assessments." It has been found that recently the Covid-19 pandemic has become a challenge for medical schools across the world when it comes to the topic of accepting donated and unclaimed dead bodies for academic purposes. Covid-19 has been a nightmare across the world, and it has happened in many cases that it has remained unknown in a diverse sector of the population until and unless they are tested, and there is a possibility of asymptomatic cases in which the people might have also died due to the comorbidities. Dead bodies are donated to institutions for academic purposes, and when they are donated, there might be a chance of posing risk factors for the ones who handle the body or embalms the body. There might be a chance of transmission of the infected virus that can lead to negative consequences [10]. The medicolegal considerations of Embalming have been elaborated in the primary article referred to in this review paper. "Embalming alters the appearance of the body, tissues and organs, making it difficult to interpret any injury or disease, detection of certain poisons (especially alkaloids and organic poisons) is rendered difficult" [1]. So it can be understood from the above considerations that the removal of specimens from the corpses should be completed before conducting the procedure of Embalming. Apart from all of the benefits that have been mentioned in the paper, there has been a presence of the hazardous effect of

Embalming. John Hopkins researchers have provided a report that the very known case of tuberculosis has been transmitted from one corpse to an embalmer. Reports of the case of HIV have been found in the fragments, bone, spleen, bone marrow and lymph from one of the patients with AIDS at autopsy, being dead for about six days. As discussed above, embalmed corpses are a great source of practical study when it comes to anatomical study in Universities and colleges. In anatomical exhibitions, those bodies were displayed in North America during the Los Angeles debut of Body Worlds in 2004. In the exhibitions, it has been found that the bodies were impregnated with the help of a polymer that helped to replace the body fluids, which delayed the process of decay. While discussing the topic of Embalming, Plastination can never be denied. This process allows the students to have hands without exposing themselves directly to formalin. Some injuries might change a bit due to the process of Plastination, but they can be recognized easily. Overall the knowledge of Embalming and Plastination has been presented in relevant articles in a detailed way, but only the primary article cannot be enough to meet all of the questions regarding the history of Embalming. The primary article is a great source of information on embalming history, but in order to gain knowledge on Plastination, assistance from other articles must be taken.

CONCLUSION

Embalming has been widely known to be one of the important techniques to preserve a dead body and make it presentable before the public. The history of Embalming has been the main topic of discussion in this paper. The traditional methods known as mummification has been elaborated on in the paper. The paper has reviewed the primary article that has been taken for reference to discuss the history and importance of Embalming. This study has also taken into consideration aspects of other articles in order to support the aspect presented by the article. The topic of Plastination has been the main topic of discussion as it is one of the advanced methods of Embalming. The importance of Plastination and the techniques that are used to preserve and sterilize dead bodies has been elaborated on in the paper. The importance of this paper is to gain knowledge in advance regarding the topic of Embalming and Plastination before conducting further research.

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