

# EMBALMMENT: A VERITABLE SOURCE OF HUMAN BODY PRESERVATION

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## ABSTRACT

Embalment 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. This paper presents a synopsis of the historical aspect of embalming and the various documented techniques of embalming in ancient and modern times.

**Keywords:** Embalment, mummification, techniques, death

## INTRODUCTION

Embalment 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 (Bernard et al., 2013). Essentially, it is the practice of preserving the body after death by artificial means. The custom of embalming has been in existence since early history in many lands and cultures. It was highly developed in dynastic Egypt where it was used for some thirty centuries. The old Egyptian procedure of mummification has however been replaced by modern techniques, some of which are faster and require no dismemberment.

There is often need for embalment in many cases of death. For example, embalment is essential for disinfections, preservation and restoration of dead body to a life-like appearance as may be required in some legal situations and medical training. Hence, this paper reviews the history and various documented techniques of embalment.

### History of embalment

Embalment has a very long and cross cultural history composed of a number of distinct periods (Ajayi et al., 2011). Egypt is credited as the land where embalming began over 5,000 years ago. It is recorded that probably before 400BC and 700AD approximately 730,000,000 bodies were mummified in Egypt because the Ancient Egyptians believed that preservation of the mummy empowered the soul after death, which would return to the preserved corpse (Ezugworie et al., 2008). Other cultures that had developed embalming processes include the Incas and Peru, whose climate also favoured a form of mummification. Other ancient peoples who practiced embalment were the Ethiopian tribes, aboriginal inhabitants of the Canary Island, Babylonians, Persians, Syrians, Greeks, Romans, Sumerians, Jivaro tribes of Ecuador, the Guanches and Tibetans (Ezugworie et al., 2008).

The second main epoch of embalment history is the period of the Renaissance in Europe, a period in which embalming techniques were primarily used to preserve the dead for purposes of dissection and study (Ezugworie et al., 2009). Descriptions of methods used in Europe for almost

1200 years, starting at about AD 500, have been preserved in the writings of contemporary physicians, such as Peter Forestus (1522–1597) and Ambroise Paré (1510–1590). Forestus described his procedure as follows: eviscerate the body, wash with cold water and aqua vita, fill cavities with consecutive layers of Aqua vita moistened cotton, and powder, sew the corpse, and finally wrap the corpse in waxed cloth and other things (Brenner, 2014). Embalming during the Middle Ages included evisceration, immersion of the body in alcohol, insertion of preservative herbs into incisions previously made in the fleshy parts of the body, and wrapping the body in tarred or waxed sheets. Later on, in the renaissance period, embalming became influenced by scientific developments in medicine. Bodies were needed for dissection purposes and preservation required more refined embalming techniques. Among these new techniques, there was the injection into hollow structures of the body, but normally not into the vascular system. Nevertheless, several attempts to inject the vascular system have been passed down (Brenner, 2014).

The third distinct period of embalment history is believed to have begun in 1861, at the start of the Civil War, to the present day. During the Civil War, embalment became more common (at least among Northern officers), initially required by public transportation services before they would take a corpse to its final resting place from the battlefield location. It became an invaluable means of maintaining corpses of prominent military officials, whose bodies might travel to a number of locations for memorial services. Additionally, embalment allowed viewing of the body without showing all the ravages of war. Embalment methods in this period consist essentially of the removal of all blood and gases from the body and the insertion of a disinfecting fluid; the viscera might be removed and immersed in an embalming

fluid and are then replaced in the body, in which they are covered with a preservative powder (Brenner, 2014). The Civil War embalmers experimented with a wide combination of compounds such as arsenic, creosote, mercury, turpentine and various forms of alcohol. Thomas Holmes, who is said to have performed about 4000 procedures, had developed arsenic-based solutions which were the first generally accepted embalming fluid. In the 19th and early 20th centuries, arsenic was frequently used as an embalming fluid, but has since been supplanted by formaldehyde (Ezugworie et al. 2009).

Reasons for embalment vary from one culture to another. Many cultures including Egypt and Greek gave the embalment processes a greater religious meaning. Other reasons for embalming are sanitation, transportation, keeping in touch with the beloved dead and befitting burial rite. Cost, legal reasons and unavailability of modern methods are also reasons for embalment (Puddle, 1968; Curtis, 2001; Mayo, 2000; Rush, 1941; Ezugworie et al., 2008).

### **Embalment methods**

Different techniques had been used to embalm bodies in ancient times and today to ward off decay. These include:

#### **Mummification**

It was the Egyptians who developed this process in ancient times. It involves the removal of the brains and viscera, filling the body cavities with a mixture of balsamic herbs and other substances and then drying-out of the cadaver. Although the brains and the viscera were removed, but the heart was left inside the body because the Ancient Egyptians believed the heart controlled all thoughts, memories and intelligence. Once mummified, the bodies were placed in a mummy case then in a coffin and in a sarcophagus (Batra, 2010; Belsare, 2017). Mummified remains and

associated artifacts are fragile and vulnerable to several types of deterioration, including those factors which result from environmental conditions, physical damage and damage caused by previous inadequate conservation attempts (David, 2001).

#### Arterial embalming

As a result of centuries of research, trial, error and invention, a standardized technique was now developed which involves four parts: the injection of embalming chemicals into the blood vessels usually via the right common carotid artery. Blood is drained from the right jugular vein. The embalming solution is injected using a mechanical pump or by gravity-fed container and the embalmer massages the cadaver to ensure a proper distribution of the embalming fluid. In case of poor circulation other injection points are used. In some developing countries the complicated injection machine or apparatus used by embalmers is not available. The embalming is infused by means of gravity-fed system (Emery and Marshal, 1991; Batra et al., 2010).

#### Cavity embalming

It is the suction of the internal fluids of the cadaver and the injecting embalming chemicals into body cavities by using an aspirator and trocar (Batra et al., 2010).

#### Surface embalming

This method is often used to supplement the other methods, especially for visible, injured body parts (Ezugworie et al., 2008; Batra et al., 2010). The embalming formula contains preservative or fixative (formaldehyde), disinfectant, modifying agent, dyes, perfuming agents and diluent. Although Formaldehyde in formalin based solutions is able to kill bacteria, fungus and preserve the body for a long time (Balta et al., 2015), the vapor secreted from formalin embalmed bodies have been suggested to be carcinogenic even with the use of personal protective equipment (Hubbell et

al., 2002; Guo et al., 2012; OSHA, 2015). The embalmed bodies also do not exhibit many qualities of living organs among which are colour, softness, pliability, the pulsatile nature of the heart and arteries and the expansion of aerated lungs (Hubbell et al., 2002).

#### Hypodermic embalming

Is injecting embalming chemicals under the skin as needed (Ezugworie et al., 2008; Batra et al., 2010).

#### Plastination

This newly developed embalming process was invented in 1987 by Gunter Von Hagen, a German physician and anatomy lecturer at the University of Herdlberg. The process consists of four basic steps: (1) fixation (for which any conventional method can be employed), (2) dehydration and defatting, (3) forced impregnation with polymer, and (4) curing of the polymer, followed by finishing and storage (Ravi and Bhat, 2011). Ever since its invention, many applications have been derived from this unique process. It is carried out in many institutions worldwide and has obtained great acceptance particularly because of its durability and the high teaching value. Plastinated specimens are dry, odourless, durable, last indefinitely and can literally be grasped. They even retain their original surface relief and cellular identity down to the microscopic level. But the process is technique sensitive, time consuming, expensive and deplastination is not possible with all types of resins (Ravi and Bhat, 2011).

#### Cryopreservation

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. However, when vitrification solutions are not used, the cells being preserved are

often damaged due to freezing during the approach to low temperatures or warming to room temperature (Batra et al., 2010).

#### Thiel embalming method

This has been developed and refined over the past three decades. The embalming process comprises of an initial perfusion followed by immersion in fluid for at least 2 months. After this the bodies can stay submerged or be stored in plastic bags; no refrigeration or vacuum packing is necessary. The embalming fluids are based on water, glycol and various salts. A number of more harmful components such as formaldehyde, chlorocresol and morpholine are only used in very low concentrations (Eisma et al., 2013). Thiel-embalmed cadavers have been used for biomechanical studies, and training for surgeons, anaesthetists performing image guided procedures and dentists.

Microbiological testing has demonstrated the excellent biocidal properties. Despite numerous advantages of this technique, the method was found to be used in only 10% of anatomic laboratories globally and is not widely recognized due to minority of trained personnel in the technique, relatively higher costs, and that fixation can take up to 6 months to process. Furthermore, the risk of mummification of the distal limbs is higher in Thiel cadavers (Healy et al., 2015).

#### Conclusion

Despite the strengths and weaknesses of the various embalment techniques, the modern embalming techniques have proven to be more effective than the ancient techniques. Since these modern methods can keep a body intact for decades without the body decomposing by autolysis and putrefaction.

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