

# Trends In The Development Of Embalming Methods

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## Abstract

Embalming has been of immense importance as a means of preserving the dead in many cultures globally. This has been done for thousands of years for religious and social reasons. The ancient Egypt developed embalming to the greatest extent through the process of mummification. This study involves extensive internet search and review of journal/internet articles. The objective is to access the trends in the development of embalming methods from ancient to the present; and its importance to the Nigerian situation. Embalming techniques evolved from accumulation of centuries of trial and error as well as research and invention. The ancient methods evolved by trial and error. In the renaissance period the embalming techniques became more refined as a result of scientific research and invention in medicine. Modern day embalming got established during the American civil wars following discoveries in medicine. In Nigeria, even though there is paucity of literature on embalming, evidence exists that traditional embalming is still in practice in the rural settings. The essential purpose of embalming is preservation of the body to permit planned burial and prevention of infection.

## INTRODUCTION

Embalming is the art and science of temporarily preserving human remains. It has been practiced in many cultures and is one of the earliest surgical procedures humanity undertook.[<sup>12</sup>]. Embalming and or some type of preservation, has been recorded in history as far back as Egyptians. In classical antiquity, perhaps the old world culture that had developed embalming to the greatest extent was that of ancient Egypt.

Embalming has a very long and cross-cultural history, with many cultures giving the embalming processes a greater religious meaning[<sup>34567891011</sup>]. Over the years the procedure has changed many times to what we now know as modern day embalming. Embalming has developed from ancient methods employed through renaissance to modern day embalming. During the middle ages, the specialists who employed the elaborate Egyptian method did a modest amount of embalming. In the renaissance period embalming became influenced by scientific developments in medicine. Bodies were needed for dissection purposes and needed to be preserved using more refined embalming techniques[<sup>1212</sup>].

The recreation of bodies and features damaged by accident or disease is commonly called restorative art or demisurgery and is a subspeciality inside embalming. Embalming of autopsy cases differs from the standard embalming because

the nature of the post mortem irrevocably disrupts the circulatory system with the removal of the organs for examination.[<sup>12131415161718</sup>].

Long term preservation requires different techniques. Regardless of how embalming is performed the body of the deceased will eventually decompose. Different process is used for cadavers embalmed for dissection by medical and funeral service students because the priority is for long term preservation.[<sup>12131415161718</sup>].

The essential purpose of modern embalming is preservation of the body to permit burial without unseemly haste and prevention of spread of infection both before and after burial.[<sup>1212</sup>].

Embalming gives funeral homes a sales opportunity to increase consumer spending[<sup>12</sup>].

In Nigeria a degree of ancient embalming methods co exist with modern methods of embalming[<sup>13</sup>]. Also cadavres are embalmed for dissection by medical students in Nigeria.

## HISTORY OF EMBALMING

Egypt is principally associated with the beginnings of the art and techniques of embalming[<sup>1319</sup>]. It is recorded that probably before 400BC and 700AD approximately 730,000,000 bodies were mummified in Egypt[<sup>10</sup>]. Much

evidence demonstrated that embalming is religious in origin[<sup>91419</sup>].

The Egyptians believed that preservation of the mummy empowered the soul after death, which would return to the preserved corpse[<sup>1</sup>].

Other cultures that had developed embalming processes include the Incas and Peru[<sup>13</sup>], whose climate also favoured a form of mummification. Other ancient peoples who practiced embalming were Ethiopian tribes, aboriginal inhabitants of the Canary Island, Babylonians, Persians, Syrians, Greeks, Romans, and Sumerians, Jivaro tribes of Ecuador, the Guanches and Tibetans[<sup>113141516171819</sup>]. Recent study showed that Nigerian tribes also practice traditional embalming[<sup>13</sup>]. Wadel (1912) in chronicling the history of embalming noted that some early Christians were embalmed though they rejected it as a pagan practice[<sup>913202122232425</sup>]. The Biblical Joseph was embalmed.

Embalming spread to Europe from the ancient peoples of Africa and Asia. Embalming in Europe was attempted from time to time, especially during the crusades, when crusading noblemen wished to have their bodies preserved for burial closer to home[<sup>1</sup>]. In ancient times, embalming was practiced in Europe, Asia, Africa and pre-Columbian culture of South America. In June 1999, a burial ground containing almost 10,000 mummies was discovered near Bawiti, 320km south west Cairo. In 2002, mummified bodies were discovered in the island of south west, in the Outer Hebrides, Scotland and dated from 10000BC[<sup>24</sup>].

Embalming began to come back into practice in parallel with the anatomists of the renaissance who needed to be able to preserve their specimens[<sup>1</sup>]. History has it that embalming in the renaissance period was minimal and by specialists only. Then scientific development influenced the practice such that discoveries in the world of medicine resulted in the development of modern embalming techniques.

The scientific trends are as follows[<sup>112141924</sup>]

\*Leonardo da Vinci (1452-1519) produced hundreds of anatomical plates as result of dissection of the human body. Vinci undoubtedly used arterial injections to preserve the specimens.

\*Dr William Harvey (1578-1657) was the English physician who discovered the circulation of blood.

\*Dr Frederick Ruysch (1665-1717) a Dutch anatomist

believed to be the first man to embalm by injecting a prepared preservative chemical solution into the blood vessels. His technique is unknown[<sup>15</sup>].

\*Anthony van Leuwenhock (1632-1783) manufactured the microscope and discovered bacteria in 1683.

\*Dr William Hunter (1718-1783) is credited to be the first to successfully adopt arterial injection as a means of preservation.

\*Jean Gannal (1721-1783) began as an apothecary's assistant and became the first to offer embalming to the French general public.

\*In 1867, the German chemist August Wilhelm von Hofmann discovered formaldehyde, whose preservative properties were soon discovered and which became the foundation for modern methods of embalming[<sup>17</sup>].

\*Dr Thomas Holmes (1817-1900) is generally considered the father of modern embalming. He experimented with preservative chemical while as a coroner's assistant in New York. He received a commission from the Army Medical corps to embalm corpses of the dead union officers to return to their families.

Contemporary embalming methods advanced markedly during the American civil war. It is said that modern embalming really got started during this period[<sup>124</sup>]. The use of ice or otherwise freezing was also introduced as embalming technique during early American embalming.

Embalming by arterial injection as a mortuary practice began in England in the 18<sup>th</sup> century by the noted English physiologist Dr William Harvey. He was said to have injected coloured solution into the arteries of cadavres. Research showed that the Dutch, German and Scottish scientists, Frederick Ruysch, Griel Claurus and William Hunter respectively used similar arterial injections for embalming of bodies[<sup>214192326</sup>]. During the 18<sup>th</sup> century William Hunter worked in London using injection fluid containing turpentine, oil of lavender coloured with vermilion for the arterial injection. He injected camphorated oil and wine into the chest and abdominal cavities[<sup>214192326</sup>].

The first generally accepted embalming preparation was arsenic solution. In the 19<sup>th</sup> and early 20<sup>th</sup> centuries arsenic was frequently used as an embalming fluid but has since been supplanted by other more effective and less toxic fluid.

Today, typical embalming fluid contains a mixture of formaldehyde, methanol, ethanol and other solvents. The formaldehyde content may range from 9 to 56 percent<sup>[ 1212 ]</sup>. The embalming fluid acts as both disinfectant as well as preservative.

### METHODS OF EMBALMING

#### ANCIENT EMBALMING

Ancient embalming methods varied according to the different cultures and peoples<sup>[ 14 ]</sup>. Descriptions of methods used in Europe for almost 1200 years from about 500AD have been preserved in the writings of contemporary physicians<sup>[ 24 ]</sup>.

Ancient embalming methods consisted of removal of the brains and viscera and the fillings of bodily cavities with a mixture of balsamic herbs and other substances. The ancient Egyptians are known for their embalming techniques. There were five physical steps in the processing of an Egyptian corpse<sup>[ 11314151617181920 ]</sup>.

Step one: removal of the brain via the nasal cavity. The skull was refilled with wax and resins.

Step two: evisceration; removal of the internal organs, stomach, liver, kidneys, heart and others. This was done through an incision in the abdomen. These organs, as well as the brain, would be placed in “Coptic jars” that had been filled with a preserving fluid with a salt base.

Step three: immersion; the body was immersed in a salt based solution. This would last anywhere from 20 to 70 days. The longer the better.

Step four: dehydration; the body would be removed from its salt bath, washed and the limbs arranged. After this they would place the deceased in the sun to dehydrate.

Step five: wrapping; this procedure would take several hours. About 1200 yards of 31\2 inch wide linen strips would be used on the average body. When wrapping was concluded, the body would be placed in its sarcophagus (and crypt) and returned to the family. Other ancient Egyptian methods meant for the poor<sup>[ 213141516171819 ]</sup>.

Use of oil of cedar injected into the body and immersion in the sodium salt solution

Purging of the intestine and covering the body with salt based solution (nitre)

Wrapping the dead in cotton and burying in charcoal and

sand beyond the reach of the Nile water (naturally preserved mummies)

The Guanches, aborigines of Canary Island, and ancient Ethiopian tribes preserved their dead using methods much like those of the Egyptians, removing the viscera and filling the cavity with salt and vegetable powder. Low fire roasting of embalmed bodies was used by Jivaro tribes of Ecuador and Peru<sup>[ 1141926 ]</sup>. Recent study showed that Idoma and Igbo tribes of Nigeria also undertake low fire roasting of embalmed bodies<sup>[ 27 ]</sup>.

In Tibet some bodies are still embalmed using the ancient formula of putting the body in a large box and packing in salt for about three months following which it goes into a mummified state. Superficial embalming by anointing the body with unguent, perfumes and spices was practiced by ancient Babylonians and Greeks<sup>[ 26 ]</sup>. The Greeks as well as Assyrians made use of honey<sup>[ 113141516171819 ]</sup> Some Nigerian tribes also practice superficial embalming<sup>[ 27 ]</sup>.

Use of alcohol<sup>[ 11314151617181927 ]</sup> in preserving human remains dates from old Egyptians, and practiced by British sea forces for many hundred of years. Nigerian tribes also use alcohol in embalming. Alexander the great was embalmed with honey and wax.

The Persians used wax and the Jews used spices and aloes. The ancient methods also included the use of hot water and hot oil. The ancient Romans washed their dead bodies for seven days with hot water and hot oil<sup>[ 26 ]</sup>. Embalming during the Middle Ages included evisceration, immersion of the body in alcohol, insertion of preservative herbs into incisions previously made in the flesh parts of the body, and wrapping the body in tarred or waxed sheets<sup>[ 113141516171819 ]</sup>.

Discoveries in the world of medicine influenced the practice of embalming in the renaissance period <sup>[ 121314 ]</sup>. Embalming by injection of a prepared preservative chemical solution into the blood vessels was first carried out by a Dutch anatomist called Dr Frederick Ruysch. His technique is unknown.

Embalming by arterial injection as mortuary practice began in England in the 18th century. Cavity embalming (chest and abdominal cavities) was then by injection of fluid containing camphorated oil and wine. Fluid for arterial injection contained turpentine, oil of lavender coloured with vermillion.

Contemporary embalming methods advanced markedly

during the American civil war. The civil war embalmer experimented with a wide combination of arsenic, creosote, mercury, turpentine and various forms of alcohol [ <sup>30</sup> ]. Dr. Thomas Holmes – “father of modern embalming” developed a fluid free of poisons by the outbreak of the war [ <sup>30</sup> ]. Arsenic based solutions were the first generally accepted embalming fluid. In the 19 [ [th]] and early 20th centuries arsenic was frequently used as an embalming fluid, but has since been supplanted by formaldehyde [ <sup>1424</sup> ]

### MODERN EMBALMING

Modern embalming techniques are the result of the accumulation of many centuries of research, trial and error, and invention [ <sup>32</sup> ]. The principles underlying the present day embalming usually involve the following [ <sup>122428</sup> ]:

- the exposure of a large artery and a large vein
- inserting tubes into these vessels
- Washing out any blood clots that are present within the large vessels.
- Running in embalming fluid, which both preserves (fixes, colours) and disinfects the tissues.
- Tying the injection sites
- Injecting preservatives into the cavities and sucking out the body fluids [ <sup>32</sup> ].

A standardized version of the actual modern embalming process usually involves four parts [ <sup>33</sup> ].

1. Arterial embalming which involves the injection of embalming chemicals into the blood vessels, usually via the right common carotid artery. The blood is displaced from the right jugular vein. The embalming solution is injected through a mechanical pump or by gravity-fed container. The embalmer massages the corpse to ensure a proper distribution of the embalming fluid. In case of poor circulation, other injection points are used.

2. Cavity embalming, the suction of the internal fluids of the corpse and the injection of embalming chemicals into body cavities, using an aspirator and trocar. 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. He then fills the cavities with concentrated chemicals that contain formaldehyde. The

incisions either sutured closed or a trocar button is screwed in place.

3. Hypodermic embalming, the injection of embalming chemicals under the skin as needed.

4. Surface embalming, this supplements the other methods especially for visible, injured parts.

Special treatment beyond that for “normal” case is required for decomposing bodies, autopsy cases, and those to be transported for long distances. The recreation of bodies and features in such cases is commonly called restorative art or demisurgery and is a sub-speciality inside embalming. For instance in the autopsy cases, a six-point injection is made through the two iliac or femoral arteries, subclavian or axillary vessels, and common carotids, with the viscera treated separately with cavity fluid or a special embalming powder in a viscera bag.

Long term preservation requires different techniques, such as using stronger preservatives chemicals and multiple injection sites to ensure thorough saturation of body tissues.

A rather different process is used for cadavers embalmed for dissection by medical and funeral service students. Medical embalmers use embalming fluids that are nearly pure formaldehyde (37-40%, known as formalin), made without dyes or perfumes. Specialized anatomical embalming fluids are also available. Anatomical embalmers may use gravity fed embalming where the container dispensing the embalming fluid is elevated above the body’s level. The fluid is slowly introduced over an extended time, at times for several days. No drainage occurs and there is no separate cavity treatment of the internal organs. Instead, the body distends with fluid that eventually reduces, leaving a normal appearance.

In most developing countries like Nigeria the complicated injection machine or apparatus used by embalmers is not available. The embalming is infused by means of gravity-fed system [ <sup>26</sup> ].

Freezing or use of ice was introduced as embalming method during the American civil war. This practice is still in existence in developing countries like Nigeria.

Technological advancement has brought a new embalming technique [ <sup>29</sup> ], sorbent technology for the 21 [ [st]] century embalming. The sorbent is a unique mixture of wood pulp and absorbent polymer. The sorbent has absorption and

solidification characteristics. The method is as follows:

The sorbent is placed into the thoracic and abdominal cavities.

Upon completion of vascular injection, the drainage was allowed to free flow into the cavities.

The drainage (fluid) is taken up by the sorbent which is removed as a solid mass, one gram of the sorbent absorbs 12 times its weight.

Accessory chemicals add a degree of disinfection and preservation.

### CONCLUSION

In conclusion, it is interesting to note that modern embalming techniques are the result of accumulation of many centuries of research, trial and error and invention.

Ancient embalming methods varied according to different cultures and peoples. Discovery in the field of Medicare influenced the practice of embalming into renaissance period.

Technological advancement is bringing new embalming techniques including sorbent technology. In Nigeria, the traditional methods of embalming coexist with modern methods including long term embalming in various medical schools.

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