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Embalmment, Islamic Legality and Medicolegal Concept: A Review

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Summary
Embalmment an art of science of temporarily preserving human remains to forestall decomposition and make it suitable for at funeral. It also assists in preserving humans for studying medical courses. It causes tissues to harden by coagulating tissue proteins that gets fixed and hardened. The aim of the study is to understand embalmment and different views from religion and socio-cultural perspectives. Research publication articles from Pubmed, Medline and many others were searched using google search engine. Over seventy journals of international repute were obtained out of which more than forty gives reputable result information of socio-cultural and medico legal effects of embalmment. Embalming human cadaver is attributed to scio-cultural effects and religious views in different part of the world.

Key words: *Embalming, Medico legal, Socio-cultural*

Introduction:

Embalming: Is the process of chemically treating the dead human body to reduce the presence and growth of microorganisms, to retard organic decomposition and to restore acceptable physical appearance (Ahmed *et al.,* 2022). The use of balms and balsams to impregnate the dead body for preservation has gained the name embalming. Embalming causes the coagulation of tissue proteins that get fixed and hardened (Rauk, 2019). In most modern cultures, Embalming is the art and science of temporarily preserving human remains to forestall decomposition and make it suitable for display at a funeral (Milton & Godwin, 2023). It involves the use of fixative (embalming fluid is introduced or perfused into the cadavers, through the arterial system to prevent autolysis and putrefaction) (A. B. Ajileye, Esan, & Adeyemi, 2018). The three major goals of embalming are thus, preservation, sanitization and presentation (or restoration of a dead body) (Uy *et al.,* 2022). Human embalming has a very long and cross cultural history, with many cultures giving the embalming process a great religious meaning (Grevy, 2022). Human embalming started in Egypt; the ancient Egyptians raised the process of embalming to a fine art in the production of their mummies (Braulińska, Kownacki, Ignatowicz-Woźniakowska, & Kurpik, 2022). Initially human embalming was carried out mainly in medical colleges in the western world before extending to other parts of the world (Brenna, 2022). 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 (Kanagasabapathy & Sathurusangaravel, 2021). Today human embalming is also employed so that a body can be transported long distance and funeral rites can be conducted with due measures (Franco *et al.,* 2022).

History of Embalming in classical antiquity perhaps the old world culture that had developed embalming to the greatest extent was that of ancient Egypt probably before 4000 BC and was used by them for more than 30 centuries (Ferrant *et al.*, 2022).

Purpose of Embalmment:

1. In medical colleges to preserve the dead bodies for the purpose of dissection (Patil, 2022).

2. When the dead body has to be transported from one country to another for burial or cremation and the time taken in transit is such as would ordinarily lead to decomposition (Chapwanya, Lubuma, Terefe, & Tsanou, 2022).
3. Necessity to preserve the dead body of some important personality for public view (Cipolletta, Entilli, & Filisetti, 2022).

History of Embalmment:

Egypt is considered a land where the act of embalming began. Base on the records in the Holy Bible, in Genesis chapter 50 verses 2 (And Joseph commanded his servants the Physicians to sis chapter 50 verse 26). During the period from 6000 BC to 600 AD approximately 400,000,000 bodies were mummified. Egyptians considered embalming human cadaver for either sanitation or religion (Lawson, 2021).

According to Greeks religion, a historian Herodotus maintained that the Egyptians were the first people to believe in the immortality of the soul (Williams & Williams, 2022). They believed that the soul would never fully forsake the body as long as the body remained intact (Howard, 2022). Embalming was for the purpose of preserving the body so that the soul could return to it after the completion of the "circle of necessity (Pryds, 2022)." This "circle of necessity" was a 3,000-year journey, the soul was required to make before it could return to the body (CHIBUZOR, 2021). At that time, the whole man would arise from the dead and live with the gods forever (Collins, 2021).

Babylonians, Persians, and Syrians preserved their dead by placing them in jars of honey or wax. By depriving the bacteria in the body of air, decomposition was prevented (X. Liu, 2022).

The Greeks believed that the deceased must make a journey across the river Styx to the land of eternity (HURDUZEU). A cake of honey was placed next to the body to appease the three headed dog, Cerebrums, who guarded the entrance to Hades. Interment was delayed three days to prevent premature burial. Cremation came into practice in about 300 BC (Wilson, 2022).

The Romans also did not practice embalming as such (Marković, Mezzatesta, Porcier, Vieillescazes, & Mathe, 2022).The body is washed with hot water for seven days and rub with oil (Kashetsky, Law, & Maibach, 2022). This delay also was to prevent premature burial. A group of slaves called Pollinctores performed this function. Funeral processions were held at night to avoid defilement of the living (Harra, 2022). The procession was managed by a Designator, who functioned much like the modern day funeral director (Gunji, 2023). Burial later gave way to cremation. At one-point cremation was forbidden within the gates of Rome because of the smoke pollution of so many bodies being burned at once (Hobson, 2022).

Mummification:

1. The brain and internal organs were removed and placed into Canopic jars (Slave).
2. The heart was left inside of the body because the Ancient Egyptians believed the heart contain all thoughts, memories and intelligence (Gschwandtner, 2022).
3. The body was covered in a salty substance called Natron then left to dry out for 40 days (Jackson, 2022).
4. The body was then filled with sawdust to lessen the limp and lifeless appearance (Helmsing & van Kessel, 2020).
5. The body was then bathed in wine and spices, wrapped in linen and left for an additional 30 days (Shrestha, Bhattarai, Mahat, Jha, & Amgain, 2019).
6. Once mummified, the bodies were placed in a mummy case, then in a coffin and then in a sarcophagus (Fulcher, Serpico, Taylor, & Stacey, 2021).

Modern Embalming Practice:

1. **Arterial embalming:** It involves the injection of embalming chemicals into the blood vessels usually via the right common carotid artery. Blood is drained from the right jugular vein (Thompson, Green, Scotcher, & Keenan, 2022). The embalming solution is injected using an embalming machine 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 (Wix, 2022).

2. 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 (SEROMA, 2020).
3. Hypodermic embalming: Is injecting embalming chemicals under the skin as needed (Gangurde, Nehare, & Sharma, 2019).
4. Surface embalming: Supplements the other methods especially for visible, injured body parts (Gangurde *et al.,* 2019).

Plastination

Is a technique or process used in anatomy to preserve bodies or body parts, first developed by Gunther von Hagens in 1977 (von Horst, von Hagens, Sora, & Henry, 2019). 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 (Kapadnis, Karmore, Gupta, & Suman).

Origin of Plastination

In November 1979, Gunther von Hagens applied for a German patent, proposing the idea of preserving animal and vegetable tissues permanently by synthetic resin impregnation (A. B. Ajileye *et al.,* 2018). Since then, von Hagens has applied for further US patents regarding work on preserving biological tissues with polymers. With the success of his patents, von Hagens went on to form the Institute for Plastination in Heidelberg, Germany in 1993 (Buikstra, 2019). The Institute of Plastination, along with von Hagens made their first showing of plastinated bodies in Japan in 1995, which drew more than three million visitors (Kumar & Sharma, 2021). The Institute maintains three international centres of plastination: in Germany, Kyrgyzstan and China (Su, 2021).

Process of Plastination

There are four steps in the standard process of plastination: fixation, dehydration, forced impregnation in a vacuum, and hardening (Baygeldi, Ozkan, Yilmaz, & Kanmaz, 2022). Curable polymers used by plastination include silicone, epoxy and polyester-copolymer (Mahesh, Ainapur, & Pradeep, 2019). The first step of plastination is fixation. Fixation, frequently utilizing a formaldehyde based solution, serves two functions (Baygeldi, Ozkan, Yilmaz, & Aslan-Kanmaz, 2022). Dissecting the specimen to show specific anatomical elements can be time consuming. Formaldehyde or other preserving solutions help prevent the decomposition of the tissues (A. Ajileye & Esan, 2022). They may also confer a degree of rigidity. This can be beneficial in maintaining the shape or arrangement of a specimen (Fundarò, Salti, Malgapo, & Innocenti, 2022). A stomach might be inflated or a leg bent at the knee for example (Mauricio Aviñó, 2022). After many necessary dissections must have taken place, the specimen is then placed in a bath of acetone (Baygeldi, Ozkan, Yilmaz, & Kanmaz, 2022). Under freezing conditions, the acetone draws out all the water from the cells (S.-H. Liu & Lee, 2022) . In the third step, the specimen is then placed in a bath of liquid polymer, such as silicone rubber, polyester or epoxy resin. By creating a vacuum, the acetone is made to boil at a low temperature (Huncik, 2022). As the acetone vaporizes and leaves the cells, it draws the liquid polymer in behind it, leaving the cell filled with liquid plastic (Cheng *et al.,* 2022). The plastic must then be cured with gas, heat, or ultraviolet light, in order to harden it (Baek et al., 2022). A specimen can be anything from a full human body to a small piece of an animal organ, and they are known as 'plastinates (Nemetz, 2022)' Once plastinated, the specimens and bodies are further manipulated and positioned prior to curing (hardening) of the polymer chains (Resch, 2022).

Importance of Plastinated specimen

Plastination is useful in anatomy as well as serving as models and teaching tools (Mogali *et al.,* 2022). Plastination is used at more than 40 medical and dental schools throughout the world as an adjunct to anatomical dissection (Chandrasekaran *et al.,* 2022). Students enrol in introductory animal science courses at many universities learn animal science through collections of multi-species and large-animal specimens (Morin, Molgaard, Royster, Johnson-Walker, & Fetrow, 2020). Plastination allows students to have hands on experience in this field, without exposure to chemicals such as formalin (Abdulrahman *et al.,* 2021). For example, plastinated canine gastrointestinal tracts are used to help in the teaching of endoscopic technique and anatomy (Bernal, Aburto, Pérez, Gómez, &

Gutierrez, 2022). The plastinated specimens retains their dilated conformation by a positive pressure air flow, which allows them to be used to teach both endoscopic technique and gastrointestinal anatomy (Nemetz, 2022).With the use of plastination as a teaching method of animal science, fewer animals have to be killed for research, as the plastination process allows specimens to be studied for a long time (YUNUS, Okan, BAKICI, BATUR, & ÇAKIR).

Embalming fluids

1. **Preservatives:** These are the chemicals which inactivate saprophytic bacteria rendering it unsuitable media upon which such bacteria thrive (Cayemitte, Raymond, & Aider, 2022). This arrests decomposition by altering enzymes and lysins of the body (Pitts *et al.,* 2022). These are a mixture of formaldehyde, glutaraldehyde and phenol (Chrobak, Iłowska, & Chrobok, 2022). Formalin refers specifically to 37% aqueous formaldehyde (Orfanidis, Gika, Theodoridis, Chatziioannou, & Raikos, 2022).
2. **Germicides (disinfectants):** Chemicals used to kill microorganisms e.g. quaternary ammonium compounds (Roccal, Zephiran Chloride) and glutaraldehyde (O'Dwyer, 2019).
3. **Modifying agents:** These include buffers, humectants and inorganic salts. These agents influence the chemical reactions produced by preservative solution and function in embalming fluids to control the action of main preservative agents (Karkera & Ranganath).
4. **Buffers:** They help to maintain acid base balance (pH) e.g. Borax, Sodium phosphate, Citrates and Sodium salt of EDTA (Ethylene diamine tetra acetic acid) (Saeedi *et al.,* 2022).
5. **Inorganic salts:** They play an important role in determining the osmotic qualities of embalming solution (Thombare *et al.,* 2022).
6. **Humectants:** they are used to hydrate the tissues e.g. Glycerol (Glycerine), Sorbitol, Glycol (Ethylene and Propylene glycol) and Lanolin (Mawazi *et al.,* 2022).
7. Anticoagulants: They retard the natural post-mortem tendency of blood to become 17 International Journal of Medical Toxicology & Legal Medicine Vol. 12 No. 3, Jan-Mar 2010 more viscous e.g. sodium citrate, sodium oxalate and sodium salt of EDTA (Chelate) (Batra, Khurana, Mahajan, & Kaur, 2010).
8. Surfactants: These are the chemicals that reduce the molecular cohesion of a liquid so that it may flow through smaller apertures e.g. Sulfonates (alkyl sulfonates or alkyl aryl sulfonates and sodium Lauryl sulphate) (Rathinavel, Priyadharshini, & Panda, 2021).
9. Dyes (colouring agents): they impart a definite colour to the embalming solution e.g. Eosin, Panacea Red, Erythrosine and Amaranth.
10. Perfuming agents'/Masking agents/ Deodorants: they reduce the harshness or raw odour of the solution e.g. Benzaldehyde, Oil of cloves, Oil of Sassafras, Methyl Salicylate (Darrell, 2022).

Medico legal Concept:

Embalming before autopsy invites liability under section 201 IPC (causing disappearance of evidence of offence or giving false information to screen offender) (Batra *et al.,* 2010). Any disrespect of the corpse invites applicability of section 297 IPC (Lazzaretti & Frøystad, 2022). The Anatomy Act provides for the collection of a dead body for teaching purpose only if death occurs in a State Hospital or in a Public Place within prescribed zone of a medical institution (Vergallo, Masotti, & Marinelli, 2022), provided the police has declared (after a lapse of 48 hours) that there are no claimants for the body and it could be used for medical purpose (Cormacain & Fairgrieve, 2022).

Hazardous effects:

1. Johns Hopkins researchers have reported the first known case of tuberculosis (TB) transmitted from a cadaver to an embalmer (Bliss & Kopec, 2022).
2. Infectious HIV has been reported in the pleural fluid, pericardial fluid, and blood of such patients after storage at 2°C for up to 16.5 days' post mortem (Chhillar, Dhattarwal, & Kataria).
3. There is also reported case of HIV recovered from bone fragments, brain, bone marrow, spleen, and lymph nodes from a patient with AIDS at autopsy six days after death (Huyveneers *et al.,* 2022).
4. An accidental injury may occur during

embalming causing occupational HIV infection (Gundreddy & Gaurkar, 2022).

5. The most frequently used fixatives and disinfectants are ethanol, formalin, and phenol in suspension tests, 25 percent ethanol and 0.5 percent formaldehyde were shown to be effective against HIV1/2.

Islamic perspective

The remains of human body after death is treated by Mummification, cremation, burial or embalming. After death the body temperature cools, rigor mortis, the blood start settling and discolours the skin, and body start to decompose by various enzyme and bacteria. For religious, cultural and sanitary reasons, this process is prevented through any of the following, depending on the culture and believes of a particular community: Mummification, Cremation, Burial or Embalming. Embalming is outlawed in most countries and unacceptable by Islamic Religion for its unnatural and intrusive procedure (Cann, 2022). Islam believes that death is not final, there is another life after death which is starting immediately from the grave to the day of judgement, in which all actions and doing in worldly life will be accounted (Negri, 2022).

Conclusion:

There are multiple counter views on embalming human cadaver ranging from socio-cultural beliefs, religious and medico legal concepts. Islam beliefs in eternal life, death is not final Islamically. Any act of preserving the human body after death is strongly contradicted to Islamic teachings. In medico legal concepts embalming alters the appearance of body tissues and organs, making it difficult to interpret any injury or disease and detection of poisons, hence removal of post-mortem organs prior to embalmment is inevitable.

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