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### A scientific study of ancient embalming and restoration of human cadaver

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#### ABSTRACT:

Anatomy is the branch of science concern with the bodily structure of humans. Specially as revealed by dissection and the separation of the parts. A study of structure of internal working of something. Anatomy is where students learn the basic knowledge of medicine. Dissection is among the most profound experience of medical school. Hence, giving the cadaver an ante mortem appearance not only generate interest for dissection but also helps to identify the structures, its course, relation and variation which are encountered during dissection. This can only be possible if cadavers were embalmed properly. The main objective of this article is to provide a brief knowledge about various processes of preserving a cadaver<sup>2</sup>.

**Keywords:** Embalming, Cadaver, Preservation, Anatomy, Dissection.

#### INTRODUCTION:

Cadaver remains a principal teaching tool for anatomist and medical educators teaching gross anatomy<sup>5</sup>. Cadaveric dissection is a good tool in learning the concepts of gross Anatomy. It helps doctors to evaluate their interest and trends towards surgical fields<sup>3</sup> and also build-up concepts which were utilised in their professional life<sup>2</sup>.

For better practical knowledge it is essential to have better knowledge of subject. For this purpose, the process of *Mritsamshodhan Paddhati* or embalming had introduced in our ancient literature<sup>1</sup>

Embalming: - Embalming, the word is derived from latin word with "em-encapsulated and balming or balsam", any aromatic resin produced by certain trees of the mint family<sup>7</sup>.

It is the science of temporarily preserving human remains to forestall decomposition and make it suitable for display<sup>7</sup>.

Purpose of Embalming-

To preserve temporarily human to forestall decomposition and make it

suitable for display at a funeral or transportation from one place to another or for religious reasons<sup>5</sup>.

Embalming for anatomical research and study<sup>7</sup>

#### DIFFERENT EMBALMING TECHNIQUES:

1. Natural Method:
  - a) Mummification
  - b) Preservation in cold or icy condition.
2. Non-natural method:
  - a) Conventional method of embalming
  - b) Refrigeration/Cryonics
  - c) Plastination
  - d) Thiel's method of embalming

#### I. a. MUMMIFICATION

Egyptians believed that for the person to live after death, the body had to be preserved in some way and the best method they knew was that of mummification<sup>5</sup>. After death the bodies of poor and ordinary people were put in the hot dry sand of the desert which preserved them naturally. The bodies of pharaohs and nobles were mummified to further ensure preservation. They believed that the pharaohs became gods after death and their bodies through mummification would last for all eternity. It took 70-80 days for them to artificially turn a dead person into a mummy<sup>5</sup>.

The following are steps they follow to mummify someone:

1. Wash and clean the body with water from Nile River<sup>5</sup>.

2. Remove internal organs because they have a lot of water<sup>5</sup>.

3. Brain was taken out.

- They believed that the brain was not very important. It was just stuffing for the head.
- Heart was left inside body. They believed that heart-controlled thoughts, emotion and served as the place where memories were stored.
- Four organs were taken out and embalmed separately. The liver, lungs, stomach and intestines. These were placed in a separate jar called canopic jar. These jars were placed beside mummy when it was later put in a tomb. Other organs were thrown away.

4. The body was covered in a type of salt called natron for forty days. It took that long for the body to completely dry out.

5. Mummy was then stuffed with incense (frankincense and myrrh) and covered with resin to make it waterproof.

6. Finally, mummy would be covered with amulets and wrapped in strips of linen (a cloth material made up of flax). Amulets are carved figures that are thought to have magical power. One important example was scarab beetle, which was placed over the heart to protect it. After mummy was complete, it would be placed in a coffin - a box usually made of wood. Egyptian coffin looked like people

they had faces, shoulders, feet and were decorated to look like the person did it real life. This coffin would then be placed along with other important items, in a tomb-a special burial chamber. The whole process has to be done only for religious purpose.

#### I. b. PRESERVATION IN COLD OR ICY CONDITION –

This is a natural method of preservation of the dead body in which the body is kept in a very cold atmosphere as in the highland of Peru and Incas in South America<sup>6</sup>. If the body is frozen soon after death and kept in that state it will be preserved for decades. If it is later exposed to warm temperature, more advanced purification is usually seen on the outer body surface than internally

#### II. a. CONVENTIONAL METHOD OF EMBALMING<sup>7</sup> -They are,

1. Arterial embalming: - Arterial embalming involves the injection of embalming chemicals into the blood vessels, usually via the right common carotid artery or femoral artery. The embalming solution is injecting using an embalming machine. The embalmer massages the cadaver to ensure a proper distribution of the embalming fluid. In case of poor circulation other injection points are used

2. Cavity embalming: - Cavity embalming, the suction of the internal fluids of the cadaver & the injection of embalming chemicals into body cavities, using an aspirator or trocar.
3. Hypodermic embalming: - Hypodermic embalming, the injection of embalming chemicals under the skin as needed.
4. Surface embalming: Surface embalming, which supplements the other methods especially for visible, injured body parts.

#### **Embalming Chemicals:**

##### **Preservatives:**

These are commonly a percentage (18-35%) based mixture of formaldehyde, gluteraldehyde, phenol which are then diluted to gain final index of the arterial solution. Water conditioner: These are designed to balance the hardness of water & help to reduce the deceased acidity<sup>7</sup>.

Cell conditioner: These act to prepare cell for absorption of arterial fluid & help to break up clots in the blood stream. Dyes: These are used to restore natural coloration & counter stain against conditions such as jaundice. e. g. erythrosine, carmine red, eosin etc.

**Humectants:** These are added to dehydrate & emaciated bodies to restore tissues to a more natural & hydrated appearance.

**Antioedemic:** These are designed to draw excessive oedemic fluid from body. Additional disinfectant: For certain cases such as tissue gas, topical disinfectants such as dis-spray are added in solution.

**Cavity fluid:** This is generally a very high index formaldehyde or gluteraldehyde solution injected undiluted directly via trocar incision into body cavities to treat the viscera. In case of tissue gas phenol-based products can be used

Steps:

1. Making solution: Take 800gm phenol, 15 gm borax & 15gm sodium citrate. Add these to a mixture of 4 lt. formalin, 1.5-2 lt. glycerine and 4 lt. normal saline.
2. Solution is to be kept in jar 8-10 feet above ground to facilitate passage of fluid due to gravity during infusion.
3. Cotton pads are to be inserted into nose, ear & mouth to avoid any leakage.
4. Cadaver is to be stretched to its full extension and incision is to be made in femoral triangle.
5. Identify femoral artery.
6. A trocar is to be inserted & fluid to be infused in both directions cephalic and caudal.
7. With the help of syringe, remaining solution is injected to the highly muscular parts such as gluteal region.
8. The whole procedure may take 4-5 hours. After examining any

sign of purification, if does not occur, cadaver is preserved in 10% solution of formalin in tank usually after 24 hours.

## II. b. REFRIGERATION/CRYONICS

- Its methodology is termed as "Cryo-preservation or cryo-conservation"

**Morgue-** A morgue or mortuary (in a hospital or elsewhere) is used for the storage of human corpses awaiting identification or removal for autopsy or respectful burial, cremation or other method.

In modern times corpses have customarily been refrigerated to delay decomposition.

There are two types of mortuary cold chambers:

### 1) Positive temperature –

Bodies are kept between 2 °C (36 °F) and 4 °C (39 °F). While this is usually used for keeping bodies for up to several weeks, it does not prevent decomposition, which continues at a slower rate than at room temperature.

### 2) Negative temperature –

Bodies are kept at between –10 °C (14 °F) and –50 °C (–58 °F). Usually used at forensic institutes, particularly when a body has not been identified. At these temperatures the body is completely frozen, and decomposition is significantly reduced but not prevented.

## II. c. PLASTINATION / POLYMER

**IMPREGNATION -** Plastination is a process that replaces body water and

fat with reactive plastics. It was first developed by Von Hagens in 1970. It is relatively new method of preservation where by the bodily fluids are replaced by liquid and is then hardened to create a solid, durable anatomic specimen that will last indefinitely<sup>8</sup>.

II. d. Thiel's Method of Embalming – “Thiel technique” was discovered by Walter Thiel. The methodology was available in the public domain, and it had been adopted by other centres indicating its reproducibility.

The embalming solution is composed of numerous ingredients with the aim to conserve texture, volume, colour, and shape of the body as perfect as possible. A fundamental basis of the solution is its high concentration of salt components causing a denaturation of proteins. This precipitation leads to a homogenization of the tissue. The physiologic texture of the tissue is maintained by further effects of precipitation and linking up caused by the embalming solution<sup>7</sup>. There is no shrinking or soaking of the soft tissues. With the composition of the solution, the different components and tissue characteristics of the body are taken into consideration.

- This technique uses a mixture of 4-chloro-3-methylphenol, and various other salts for fixation, boric acid for disinfecting and ethylene glycol for the preservation of

tissue plasticity, while the concentration of formalin is kept to a strict minimum (0.8%). Two stem solutions (A and B) are prepared. Using these two stem solutions as the base, the fluid for embalming and storage are constituted.

## DISCUSSION

Embalming human remains for burial has taken a long road to its present state<sup>7</sup>. During ancient periods it was done by wrapping cadaver with some drugs then kept in a cage and placed in flowing water<sup>2</sup>. It was done only for study purposes. Later on dead bodies were put in the hot dry sand of the desert which preserved them naturally. Egyptian embalming was a religious practice, as preservation of the body was a necessary precursor to resurrection in the afterlife<sup>5</sup>. As Christianity became more dominant in the area, the practice was suppressed<sup>6</sup>. Later on in Europe embalming techniques were primarily used to preserve the dead for purposes of dissection and study<sup>7</sup>. Different experimentations were done for making preservative chemicals starting from hot air up to inject able solutions. Further arsenic and mercury were used for this restorative art but later on banned due to their hazardous effects<sup>8</sup>. Now these days formaldehydes were used for this purpose

## CONCLUSION:

A science of preserving human body for anatomical study and research. Most of the medical students do have little knowledge about details of embalming<sup>7</sup>. This approach will be useful as an introductory especially for the fresher in medical profession.

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