

## **EMBALMING: A PROCEDURE TO PRESERVE HUMAN BODY WITH AN ANATOMICAL CONSIDERATION**

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### **ABSTRACT**

Embalming is an art with a science behind it. Nowadays, embalming is done to put body for dissection, display at funerals or for religious reasons. The treatment of dead body with aqueous solution of soluble germicide and preservative chemicals by intravenous or similar way of injection so that putrefaction can be prevented is called embalming. Here in this article we have discussed about anatomical consideration of embalming, embalming fluid, and procedure of embalming in detail.

**KEYWORDS:** Anatomy, Embalming, Chemicals, Type of embalming, dead body.

### **INTRODUCTION**

Definition of embalming – A process of chemically treating the dead human body to reduce the presence and growth of the micro-organism which causes decomposition and restore acceptable physical appearance of the dead body.<sup>[1]</sup>

### **ANATOMICAL EMBALMING**

Teaching of anatomy of human body is an integral part of the study of medicine. Dissection of the dead is the best method to study the human anatomy of different body parts. The dissection of the body is lengthy procedure and dissected parts of the body are displayed for longer duration without decomposition and dehydration. Therefore proper preservation of the cadaver is necessary. There is a difference between anatomical embalming and funeral embalming. The main criteria for anatomical embalming is proper preservation and sterilisation and suitability for dissection. For this purpose venous drainage and cavity treatment is not necessary.

**TYPE OF EMBALMING<sup>[3]</sup>**

- I. Arterial embalming – it involves injection of embalming chemical into the blood vessel usually via the right common carotid artery. Blood is drained from right jugular vein. The embalming solution is injected using an embalming machine and the embalmer massage the cadaver to ensure a proper distribution of the embalming fluid. In case of proper circulation other injection point are used.
- II. Cavity embalming – injecting embalming chemical in the cavity such as thoracic, abdominal, cranial etc. as needed.
- III. Hypodermic embalming – is injecting embalming chemical under the layer of skin as needed.
- IV. Surface embalming – supplement to other method especially for visible, injured body parts.

**PURPOSE OF EMBALMING<sup>[2]</sup>**

1. In medical college to preserve the dead bodies for the purpose of dissection.
2. When the body has to be transported from one place to another place for burial or cremation and the time taken in transit is such as it would ordinarily lead to decomposition.
3. Necessarily to preserve dead body of some important personality for public view.

**AIM**

about anatomical consideration of embalming, embalming fluid, and procedure of embalming in detail.

**OBJECTIVE**

1. To explain anatomical consideration in relation to embalming.
2. To explain procedure of embalming in detail.

**REVIEW LITERATURE****A. CHEMICAL USED IN EMBALMING<sup>[4]</sup>**

Embalming fluid is a mixture of various chemical which helps to retard decomposition of body, which are enlisted below –

- I. Preservative – these arrest the decomposition by altering enzyme and lysins of the body. These are mixture of formaldehyde, glutaraldehyde, and phenol. Generally, formalin refer specifically from 5% - 37% of aqueous formaldehyde and the methanol content may range from 9 – 56%. Methanol is used to hold the formaldehyde in solution.

- II. Water conditioner – these are meant to balance the “hardness” of water, as the presence of traces of other chemical that changes water’s PH neutrality and to help reduce the deceased’s acidity, a by-product of decomposition as formaldehyde works best in an alkaline environment . Additionally, water conditioner helps to neutralise chemotherapy drugs, antibiotics, which may bind to and render ineffectual the preservative chemical.
- III. Cell conditioner<sup>[5]</sup> – these chemical act to prepare cell for absorption of arterial fluid and help break up clots in the bloodstream.
- IV. Dyes – active dyes are used to restore body’s natural colouration and counter stain against condition such as jaundice as well as to indicate distribution of arterial fluid. Inactive dyes are used by the manufacturer of the arterial fluid to give a pleasant colour to the fluid in, but do nothing to the appearance of the embalmed body. Ex – ponceau red, erythrosine, Amaranth.
- V. Modifying agents<sup>[6]</sup> – this includes buffer humectants and inorganic cells. These agent influence the chemical reaction produced by preservative solution and function in embalming fluid to control the action of main preservative agents.
- VI. Buffers- help to maintain acid base balance. Ex – EDTA
- VII. Inorganic salts<sup>[7]</sup> – they are important in determining osmotic qualities of the embalming solution.
- VIII. Humectants<sup>[8]</sup> – these are added to dehydrated and emaciated bodies to help to restore issues to a more natural and hydrated level.
- IX. Anti-oedemic chemicals<sup>[9]</sup> - these are opposite to the humectants, these are designed to draw excessive fluid from body.
- X. Anti-coagulants<sup>[10]</sup> – they retard the post-mortem tendency of blood to become more viscous. Ex- Sodium Citrate, Sodium Oxalate and Sodium Salt of EDTA.
- XI. Surfactants<sup>[11]</sup> – these are chemicals that excludes the molecular cohesion of a liquid so, that it may flow through smaller apertures ex- sulfonates, alkyl sulfonates, alkyl aryl sulfonates, and sodium luryl sulfate.

All chemical in the embalming fluid are designed to preserve and sanitise the body. The factor considered in selection and preparation of an embalming fluid are age, sex, status of body, weather condition, type of embalming (anatomical or funeral). The composition of the chemical in embalming fluid, varies in most of the medical colleges.

With the help of chemical enlisted above; fluids for different purposes are used, among which main three type of fluid which actually get installed inside the body during embalming; are as given below/<sup>[12]</sup>

A) Arterial fluid – it is injected into extremities of the body through vascular system. Its content and concentration differs as per the condition of body.

**Table no 1: Arterial fluid for obese.**

<b>Preservative</b>	<b>Formalin</b>	<b>10%</b>
	Methanol	55%
Buffer	Sod. Borate	15%
Anticoagulant	Sod. citrate	15%
Wetting agent	Glycerine	15%
Germicide	Phenol	5%
Vehicle	Water	15%
Fungicide	Thymol	Few crystal
Dye	Eosin	1%
Perfume	---	10ml

**Table no. 2: Arterial fluid for thin body.**

Preservative	Formalin	10%
	Methanol	55%
Buffer	Sod. borate	15%
Anticoagulant	Sod. Citrate	15%
Wetting agent	Glycerine	20%
Germicide	Phenol	5%
Vehicle	Water	10%
Fungicide	Thymol	Few crystal
Dye	Eosin	1%
Perfume	Winter green	10ml

Above concentration is needed to prepare 1 litre of arterial fluid; glycerine should be reduce in fatty body and in hot countries formalin concentration should be doubled.

#### B) Cavity fluid

It is injected into to body cavities i.e. thoracic, abdominal & pelvic with the help of trocar. It is also injected hypodermically into areas of body that have not received arterial fluid. For an average body 2 lit of fluid is injected with a trocar over the viscera of the thoracic, abdomen, and pelvic cavity. Cavity fluid preserve & disinfect the wall & parenchyma of organ, contents of hollow viscera.

### c) Pre-embalming fluid

At death there is contraction of arterial system which forces greater volume of blood into capillary bed and venous system. Pre injection fluid is injected into the body before the arterial solution. It removes blood and cleans vascular system and improves drainage. Mainly it contains anticoagulant and buffers. Approximately 4 to 5 litres of pre injection fluid should be injected and waiting period of about 30 minutes be given before arterial fluid is injected.

### B. Fluids used in dissection laboratories<sup>[13]</sup>

- Paint mixture – During dissection body will require frequent moistening and antifungal treatment. The paint solution is applied or sprayed on the dissected body depending upon the temperature and humidity of the surrounding. It is not needed to transfer body to the tank periodically if the good care for moisture and antifungal treatment is observed for.

Purpose- for keeping body moist.

**Table no.3: content of Paint mixture.**

1	Glycerin	75%
2	Alcohol	10%
3	Phenol	5%
4	Water	10%

- Tank (immersion) fluid – Purpose- for immersing cadaver.

**Table no. 4: Content of Tank fluid.**

1	Formalin	15%
2	Glycerine	20%
3	Phenol	5%
4	Water	60%

- Cloth fluid

Purpose – prevent drying of area under dissection and isolated dissected part.

**Table no. 5: Content of cloth fluid.**

1	Formalin	5%
2	Glycerine	50%
3	Phenol	5%
4	Water	40%

**C. EMBALMING FLUID SHOULD HAVE FOLLOWING PROPERTIES<sup>[14]</sup>**

- I. It must render body free of risk or fear of infection when comes in contact with embalmer.
- II. It should help to maintain life-like appearance of the body as much as possible.
- III. Along with preservation of the body and prevention changes occur due to decomposition, which often result in odious purging and discharge from various orifices of the body.
- IV. Prevent contamination of body with insects and maggots.
- V. And for this purpose various solution in particular amount is mixed and is called Embalming fluid.

**D. QUANTITY OF FLUID REQUIRED FOR EMBALMING<sup>[15]</sup>**

Number of factor determines the strength and amount of fluid required for effective embalming of a body. It includes weight, age, Obesity, Moisture content of body time between death and preparation. There is 6 to 7 litres of blood in the vascular system of an average body. This account for approximately 8% of total body weight. Usually the amount of the arterial fluid injected should be equal to the blood volume of the deceased to ensure effective embalming.

**E. CRITERIA FOR SELECTION OF VESSEL FOR EMBALMING PURPOSE<sup>[16]</sup>**

- I. Size of the vessel – the vessel should be sufficiently large to afford proper insertion of the cannula for proper embalming.
- II. Depth of location of the vessel- Vessel should be superficial enough to avoid unnecessary dissection.
- III. Proximity to heart – Vessel chosen for injection or drainage should be as close as possible to the heart and the right atrium.
- IV. Choice in infant and children- in infants and children choice of vessel is abdominal aorta and inferior vena cava.
- V. Choice of vessel in autopsied body - This depend upon the extent of mutilation and the post mortem carried out. Abdominal aorta is use directly for injection. Multiple injection method is used when more than one vessel has to be open for one area. In autopsied body there are six primary injection site right and left common carotid artery, right and left femoral artery, right and left subclavian.

**F. INJECTION METHOD<sup>[17]</sup>**

Various methods are used for injection and drainage of fluid on basis of pre-embalming consideration.

- I. One point injection – in this one site is use for injection and drainage. Most commonly use point site are carotid artery and internal jugular vein, femoral artery and vein, external iliac artery and vein, axillary artery and vein.
- II. Split injection – the injection is given at one site and drainage occur at a vein at another location. This method provides more even distribution of the arterial fluid. As two incision are requires this procedure requires more time for vessel preparation and suturing. Most commonly used vessel for tis methods are-

**Table no. 6: Vessel use for injection and drainage purpose.**

<b>Injection</b>	<b>drainage</b>
Femoral artery	Internal jugular vein
Common carotid Artery	femoral vein
Axillary artery	Int. jugular or Femoral Vein

**III. Multipoint Injection**

Any combination of two or more arteries for injection constitutes in this method. This method preferred when distal areas of the body has to be injected and it also allow to use different strength of fluid in different body region. Drainage is done from each injection site or from one drainage point. This method is preferred in following condition-

- a. When body exhibits poor fluid distribution after one point injection method is used.
- b. In body with generalised oedema
- c. Body showing evidences of decomposition
- d. Dead body of long time period.
- e. Bodies of highly contagious disease.
- f. In autopsied body.

**IV. Six point injection method**

In autopsied body six point injection method is used. Each body extremity is embalmed separately.in this method six arteries are exposed.

- a. Identify, raise and ligate the following vessel (6 point Injection)<sup>[18]</sup>

Right internal jugular vein (insert a drain tube toward the heart)

- a. Right common carotid artery (insert injection tube toward head or heart)
- b. Left common carotid artery (insert injection tube toward head, tie off proximal end.)

- c. Right axillary or brachial artery (insert injection tube toward right hand and ligate proximal end.)
- d. Left axillary or brachial artery (insert injection tube toward left hand and ligate proximal end.)
- e. Right femoral artery (insert injection tube toward foot and ligate proximal end)
- f. Left femoral artery (insert injection tube toward foot and ligate proximal end)

#### V. Restricted cervical injection

This method enables embalming of head, Neck and face region separately. Recommended in body with facia trauma, generalised oedema, bodies likely to purge, and cases of eye enucleation.

#### F. INJECTION SHOULD BE GIVEN IN FOLLOWING ORDER<sup>[19]</sup>

- a. Right leg, left leg
- b. Right arm left arm
- c. Trunk of the body
- d. Left side of the head, right side of the head.

#### G. DRAINAGE TECHNIQUE<sup>[20]</sup>

To obtain good embalming result one must ensure good drainage from all parts of the body. After death 85% of blood is found in capillaries, 10% in veins and 5% in arteries. If part of the body where blood from vessel is emptied will only be able to allow arterial fluid to flow through them whereas in other part where clotted blood is present there this fluid will become stagnant. And this may render embalming ineffective.

##### I. Purpose of drainage is as follows

- a. To make room for embalming fluid in vessels so that it can be evenly distributed throughout body.
- b. Avoid discolouration, odour and gas formation,
- c. Prevent decomposition.
- d. Removal of blood from body help to remove microbes from the body.

##### II. Content of drainage

- a. Blood & blood clot
- b. Interstitial fluid and lymphatic fluid.



c. Embalming fluid

III. Drainage sites

- a. Internal jugular vein – largest systemic vein. Rt. Internal jugular vein lead directly to right atrium so the right is preferred over left internal jugular vein. It is accompanied by common carotid artery which can be used for injection so only one incision is needed.
- b. Femoral vein – it is large and easily accessible and because o its location the incision is not visible. It is also assisted by gravity in draining blood from body.
- c. Right atrium of heart – in difficult cases this can be used for draining purpose.
- d. Inferior vena cava- used in bodies where autopsy has been performed.

IV. Method of drainage

For this purpose an injection with a fluid containing 2% formalin is recommended.

- a. Alternate method- in this method Injection and draining is alternated till desired effect of embalming is achieved. But the method id time consuming.
- b. Concurrent / Continuous drainage- Injection and drainage are allowed to proceed at the same time. It is less time consuming but distribution of the fluid is poor.
- c. Intermittent Drainage – it is a compromised method between above two methods. Injection is continuous throughout embalming whereas drainage is stopped for a definite period.

If this also does not produce sufficient effect other methods like surface and hypodermic embalming methods are used.

## H. TECHNIQUE OF EMBALMING<sup>[21]</sup>

### I. Arterial embalming

In this process the fluid is injected into the selected artery with simultaneous drain of blood from selected vein to make a room for preservative fluid. The preservative fluid is distributed from arch of aorta and does not flow through heart as it does in the living. There are several factor which determines flow of fluid into the tissue like capillary resistance, chemical composition, injection pressure osmosis, diffusion etc. for arterial embalming following procedures are used.

- Gravity injection - it is traditional safest and least expensive method. It requires graduated glass bottle of capacity ten litres with an outlet. This outlet is closed with cork through which a nozzle is passed which connected to transparent rubber tubing with a screw

clamp to control the rate of flow. Other end is attached to T-connection which leads to two rubber tubing connected to injection needle separately. Embalming bottle is filled with arterial fluid and kept at a height of about 4 to 6 feet not more than that as raise of 1 feet gives fluid pressure of 0.43 pound. By the pressure of the gravity fluid start flowing. To overcome obstruction and to increase the flow of fluid pressure is generated by cycle pump.

- Electric pump – It is a simple device where pressure is generated to force fluid from injection tank to the vascular system. Fluid does not flow through the machine as it only provides air pressure. Provides steady and high pressure. Delivers 8 to 10 litres within 35 to 40 mins.

#### Supplemental methods of embalming

These methods are use when a particular area of the body is mean to preserve which have not received sufficient preservative fluid. These includes – 1) Hypodermic embalming 2) Surface Embalming

- a. Hypodermic Embalming – this method aim to preserve small local body areas or large local areas through subcutaneous injection of the suitable chemical may be arterial fluid or cavity fluid injected by hypodermic syringe and needle ranging from 8 to 9G and varying length.
- b. Surface embalming – Local areas are preserved by application of suitable preservative fluid to the surface of body topically. Pack of cotton or gauge soaked in chemical applied to external raw skin areas. Ex – burn tissue, bed sores, surface lesion.

Hypodermic or surface embalming may be use as a primary method for preservation of infant, foetus, viscera or mutilated portion of the body.

#### **I. EMBALMING METHOD AND SPECIAL CASES OF BODY.<sup>[22]</sup>**

a) Burn bodies – burn caused by electric shock, heat, or chemical agents; in such cases effectivity of embalming depend upon the degree and extent of burn. If body comes in blistering condition, this blisters are open and drain after this denuded skin is treated with surface embalming. Though selection of vessels for injection and drainage in burn body is depend upon the extent of burn but right common carotid artery and internal jugular vein respectively. For embalming purpose strong arterial fluid is use.

b) Embalming of the body exposed to radiation – Body treated with radiation should not be readily embalmed till radiation expert certifies that the body is safe for embalming. Body

treated with radiation tend to emit gamma and beta rays. Beta rays can be stopped easily but gamma rays require lead shielding. These bodies are certified as safe when range of radiation is within 37 millicuries for gamma radiation in un-autopsied body; 5 millicuries for autopsied body. Before embalming of such bodies must be washed several times with water. Embalming is done with strong arterial fluid.

c) Ascites – In this condition fluid is collected in abdominal cavity which make abdominal wall distended. Before embalming pressure of abdominal wall is relived then embalming is done with arterial solution.

d) Bed sores – cotton pack soaked in cavity fluid or phenol is kept on ulcer. Embalm body then cavity fluid is use to inject hypodermically at ulcer.

e) Infant body – while embalming infant body one should give attention to the relation between total body water to fat. At birth body water is 75% of the total body weight, whereas fat is 12%. At one year age body water is 60% of total body weight with 30% of fat to total body weight. Infant's tissue contain higher level of water. In disease condition where or drugs causing increase in tissue moisture in such cases arterial solution for embalming used is of same dilution as that of an adult body. Infant body requires less amount of fluid for embalming.

## CONCLUSION

Embalming procedure is a mixture of science and physics. Along with arterial embalming method other supplementary methods are used to protect body against putrefaction. Dilution or concentration of embalming fluid is decided as per the condition of the body. Though the standard procedure to embalm body are same but a close consideration is always required while choosing an appropriate method and concentration of fluid for embalming.

## REFERENCES

1. ML Ajmani, Embalming Principle and law, Reprint 2009, Jaypee Brother and publisher, pg.no-4.
2. ML Ajmani, Embalming Principle and law, Reprint 2009, Jaypee Brother and publisher, pg.no-12.
3. ML Ajmani, Embalming Principle and law, Reprint 2009, Jaypee Brother and publisher, pg. no-26.
4. ML Ajmani, Embalming Principle and law, Reprint 2009, Jaypee Brother and publisher, pg.no-54.

5. Arvinder Pal Singh Batra et al, Embalming and other method dead body preservation, International Journal of Medical Toxicology and Legal Medicine, Vol12, No.3, June-Mar 2010.
6. Arvinder Pal Singh Batra et al, Embalming and other method dead body preservation, International Journal of Medical Toxicology and Legal Medicine, Vol12, No.3, June-Mar 2010.
7. Arvinder Pal Singh Batra et al, Embalming and other method dead body preservation, International Journal of Medical Toxicology and Legal Medicine, Vol12, No.3, June-Mar 2010.
8. Arvinder Pal Singh Batra et al, Embalming and other method dead body preservation, International Journal of Medical Toxicology and Legal Medicine, Vol12, No.3, June-Mar 2010.
9. Arvinder Pal Singh Batra et al, Embalming and other method dead body preservation, International Journal of Medical Toxicology and Legal Medicine, Vol12, No.3, June-Mar 2010.
10. Arvinder Pal Singh Batra et al, Embalming and other method dead body preservation, International Journal of Medical Toxicology and Legal Medicine, Vol12, No.3, June-Mar 2010.
11. Arvinder Pal Singh Batra et al, Embalming and other method dead body preservation, International Journal of Medical Toxicology and Legal Medicine, Vol12, No.3, June-Mar 2010.
12. ML Ajmani, Embalming Principle and law, Reprint 2009, Jaypee Brother and publisher, pg.no-135.
13. [http:// www.slideshare.net/peedujaanu/embalming-i-ii-iii](http://www.slideshare.net/peedujaanu/embalming-i-ii-iii).
14. ML Ajmani, Embalming Principle and law, Reprint 2009, Jaypee Brother and publisher, pg.no-140.
15. ML Ajmani, Embalming Principle and law, Reprint 2009, Jaypee Brother and publisher, pg.no-125.
16. ML Ajmani, Embalming Principle and law, Reprint 2009, Jaypee Brother and publisher, pg.no-126.
17. ML Ajmani, Embalming Principle and law, Reprint 2009, Jaypee Brother and publisher, pg.no-131.
18. [http:// www.slideshare.net/peedujaanu/embalming-i-ii-iii](http://www.slideshare.net/peedujaanu/embalming-i-ii-iii).
19. [http:// www.slideshare.net/peedujaanu/embalming-i-ii-iii](http://www.slideshare.net/peedujaanu/embalming-i-ii-iii).

20. ML Ajmani, Embalming Principle and law, Reprint 2009, Jaypee Brother and publisher, pg.no-132.
21. ML Ajmani, Embalming Principle and law, Reprint 2009, Jaypee Brother and publisher, pg.no-129.
22. ML Ajmani, Embalming Principle and law, Reprint 2009, Jaypee Brother and publisher, pg.no-157.