



Art of Preservation of Human Cadaver: The Embalming Techniques

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ABSTRACT

Embalming technique is the time-tested procedure for the preservation of human cadavers. The composition of the embalming fluid, techniques vary in different regions. To determine the embalming techniques used in different areas for the best preservation outcome. The materials comprise of the chemicals used in the embalming fluid and the human cadavers in the anatomy department of the medical colleges for the purpose of teaching and hands-on training over a period of 10 years. The embalming fluid was prepared according to the standard composition and changes in the quantity of some constituents were made according to the atmospheric conditions prevailing in that part of the state. The gravity and pressure embalming methods were practiced. At places where gravity embalming machine was unavailable, saline bottle with IV infusion set was used till 9-10 litres of embalming fluid had been injected. Common carotid and femoral arteries were chosen to inject the fluid. A combination of gravity embalming and injection techniques proved to get better results when compared to the pressure embalming technique for the purpose of dissection. In the areas where the temperature is dry and hot, the proportion of glycerol in the embalming fluid was increased replacing methanol partly. In the places with humid climate, the embalming fluid composition was modified where glycerol was reduced considerably and thymol crystals were added abundantly to prevent fungal invasion. The embalming procedure was completed by injecting the fluid near the medial angle of the eye holding the syringe at an angle to irrigate the cranial cavity. The embalming fluid is made to trickle down overnight by gravity method to ensure perfect embalming. A precise embalming technique procures a remarkable cadaver that preserves every minute detail of the human architecture where the students profess to learn by dissection but not from the tenets of philosophers. Embalming techniques provide naturally appearing cadavers to the dissection lab, the place where the dead teach the living.

INTRODUCTION

Embalming is the art of preservation of human or animal after death by injecting the embalming fluid. The process of embalming restores the natural appearance and halts the decaying of biological tissue for a long time. Embalming methods for funeral purpose now consists essentially of removal of all blood and gases from body and the insertion of disinfecting fluid. Safeguarding the deceased for public viewing is crucial in funerals and in situations of unforeseen tragedies till they are handed over to their kith and kins. The American board of funeral service education^[1] defines embalming as a chemical treatment of human dead body to reduce the presence and growth of microorganisms, to temporarily inhibit organic decomposition and to restore to acceptable physical appearance. Embalming is also done for the unclaimed and donated bodies where the human cadaver is used as a distinct educational tool. Knowledge regarding the constituents and techniques of injecting the embalming fluid are essential for the health professionals. The preservation of human bodies after death using chemicals was practiced by the Egyptians and people from Chinchorro culture as given by Smith *et al.*^[2]. A variety of chemicals like Epsom salt, arsenic, paraffin etc. had been used prior to the advent to modern chemicals. Brenner^[3] elaborated on the old and new techniques in preserving human bodies. The embalming fluid widely used in the present era is primarily composed of 37% w/v formaldehyde in major proportion as proposed by Ajmani^[4]. The other constituents are glycerol, methanol, water, eosin, eucalyptus oil, thymol, sodium bicarbonate and sodium citrate. Erskine^[5] presented his research on anatomical preservative solutions. Janczyk *et al.*^[6] studied on ethanol- polyethylene glycol as the constituents of the fluid. For effective embalming, the proportions have to be varied according to the climatic conditions prevailing in that geographical area. The prime methods of embalming are arterial and cavity which can be supplemented by hypodermic and surface embalming methods. An enormous literature review explains the theoretical methods and methodologies of embalming procedure but the perfect preservation is achieved practically only when some modifications in the techniques are made accordingly.

MATERIALS AND METHODS

The embalming fluid was prepared using the chemicals available in the department. 65 human cadavers (43 males and 22 females) of age ranging between 50-85 years were embalmed under supervision in different medical colleges in Andhra Pradesh over a period of 10 years. Cadavers embalmed for the purpose of teaching only were counted for the

present study. Embalming done for other reasons were excluded. As a part of arterial embalming, the femoral artery and common carotid arteries were used to inject the embalming fluid. The gravity and pressure embalming machines were used for embalming. At a government medical college during its inception where neither of the machines were available, the embalming fluid was injected by femoral artery using a saline infusion bottle. This was tedious as the saline bottle could accommodate 450-500 mL of fluid when 10-12 L of the fluid had to be injected. Embalming was assured to be completed after confirming the oozing fluid through ears and nostrils and fullness of the abdomen. About 80-100 mL of fluid was injected with a 10 cc syringe into the medial angles of the eye to preserve the brain. The cadaver was kept dry for 24 hours and then immersed in the tank fluid for a minimum of 6-8 months for dissection purpose

RESULTS

The conventional constituents of the embalming fluid for arterial embalming are given in the following table.

In our experience, at Anatomy department of a private medical college at Guntur and at a government medical college at Ongole, where the temperature was dry and hot, the proportion of glycerol in the embalming fluid was increased. At medical colleges in Visakhapatnam, where the climate is humid, glycerol was reduced considerably and thymol crystals were added abundantly to prevent fungal invasion.

DISCUSSION

Across ages, Embalming technique is the proven traditional method of preserving the human cadavers for funeral or teaching purpose. Students and educators learn the human architecture through dissection. Motivated donors, voluntarily donate themselves through charities to serve after death. A perfect embalming procedure is needed to preserve every minute detail of the human architecture to serve the purpose. The present study was done to describe the changes and modifications needed to be followed practically at different geographical regions. It is

Table 1: Chemicals used to prepare 15 litres of embalming fluid

Name of the constituents	Quantity
Preservative –Formaldehyde(37% W/V)	10%
Wetting agent-Glycerine	5%
Vehicle-Water	85%
Anti-coagulant-Sodium citrate	900 g
Buffer-Sodium borate	600 g
Colouring agent –Eosin	5 mL
Fungicidal –Thymol crystal	30 g
Perfume –Eucalyptus oil	10 mL

Table 2: Changes made in embalming fluid composition at various places

	Formalin	Glycerol	Thymol	Water
Hot and dry	10%	10%	2%	78%
Humid	12%	6%	2%	80%

suggested that femoral artery is the best site for embalming as it is easily dissectible and the cannula will remain in its position without slipping. Even when the pressure embalming machines were procurable, we preferred gravity method for a hassle free embalming. Though embalming is the best way to preserve the human cadavers for teaching purpose, the formaldehyde used in the fluid is considered to be a genotoxic contaminant. Khaliq and Tripathi^[7] and Shekhawat *et al.*^[8] illustrated the effects of formalin on pulmonary functions and cytogenetic effects respectively. It is categorized as an occupational hazardous agent as described by Viegas *et al.*^[9] and Vohra^[10]. A novel technique called Plastination using S-10 polymer by Von Hagens^[11] has been gaining attention to preserve the human specimens for teaching in the labs. The present study demonstrates the methodical approach for a perfect embalming technique.

CONCLUSION

We conclude that a meticulous embalming technique overcoming the practical difficulties fulfils the sole purpose to preserve every minute detail of the human architecture, where the students profess to learn by dissection but not from the tenets of philosophers. As the saying goes "old is gold", the embalming procedure is the long established technique of preserving human cadavers that provide the education tools to the dissection halls which are considered as the places where the dead teach the living.

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